Health Care Financing Grants & Contracts Report

Extension of Autogrp Capability and Its Integration into the Total PSRO Data and Information System

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EXTENSION OF AUTOGRP CAPABILITY AND ITS INTEGRATION INTO THE TOTAL PSRO DATA AND INFORMATION SYSTEM

This report was made pursuant to contract no. HCFA-500-77-0043 between the Health Care Financing Administration, Department of Health, Education, and Welfare, and Yale University.

The Project Officer for this contract was Paul Pomerantz, Division of Data Planning and Analysis, Health Standards and Quality Bureau.

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INTRODUCTION

Under a previous contract* with the Health Standards and Quality Bureau, the Center for Health Studies, Yale University, demonstrated the effectiveness of the patient management technique of the AUTOGRP system and the application of the patient classification scheme based on the 383 diagnosis related groups (DRGs) in helping PSROs discharge their responsibility with regard to concurrent review, profile analysis, and medical care evaluation studies. The scope of work included the provision of six pilot sites with access to the AUTOGRP system, with training and technical assistance as needed, and the generation of hospital profiles and screening limits, based on the patient groups defined by the patient classification scheme, used by the PSROs in their review activities. The participants in this experiment used the system to manipulate and analyze their data and to identify MCE study topics. The Center evaluated the overall contribution of the system tc the effectiveness of PSRO operations with input from personnel at each of the sites.

The six PSRO's that participated in this project were:

1. Central Massachusetts Professional Standards Review Organization (CMPSRO), Worcester Massachusetts
2. Colorado Foundation for Medical Care (CFMC), Denver, Colorado
3. Dade-Monroe Professional Standards Review Organization (Dade-Monroe), Miami, Florida
4. Multnomah Foundation for Medical Care (MFMC), Portland Oregon

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*Contract No. 240-75-0051, entitled "Implementation, Evaluation, and Extension of a Patient Care Monitoring Mechanism"; Robert B. Fetter, Principal Investigator and Donald Riedel, Co-Principal Investigator; June 30, 1975 - October 31, 1977.

5. South Carolina Medical Care Foundation (SCMCF), Columbia, South Carolina
6. Wisconsin Professional Review Organization (WISPRO), Madison, Wisconsin.

Five of these sites (CMPSRO, Dade-Monroe, CFMC, MFMC, WISPRO) sent tapes of data from their region for processing. Databases accessible through AUTOGRP were constructed from these tapes and made available to the PSROs for analysis through the Yale Computer Center (YCC). Each site had an account established at YCC and was provided with a terminal and dataphone with which it established interactive communication with the database using TELENET. It was arranged to have AUTOGRP installed at the University of South Carolina Computer Center, which maintained SCMCF's database and provided them with interactive access to it. All participants utilized the system during the course of the experiment and provided feedback regarding their application of the system through periodic written progress reports, telephone calls, users' forums, and a final report in August 1977 in which they evaluated the overall utility of AUTOGRP in their operations. A final report documenting the Center's work performed under this contract and the PSRO's evaluation of the utility of the system in their operations was submitted to the Health Standards and Quality Bureau upon completion of the experiment.[1]

Based on the experiences reported from the sites, the system extended the capability of a PSRO in several ways important to the discharge of its responsibilities. By providing rapid and flexible access to its data, the system enabled the PSRO to respond to requests for information, to determine quickly whether or not there is any substance to suspected problems in utilization, to focus on areas of practice which are anomalous in some way, to detect patterns of utilization which deserve detailed analysis, and in general to use its own data effectively to understand and control the delivery of health care within its responsibility.

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[1] "Implementation, Evaluation, and Extension of a Patient Care Monitoring Mechanism," Final Report, Contract #HCFA-240-75-0051, Center for Health Studies, Yale Universi

Thus, as strictly an incremental capability to an existing data processing and information system, AUTOGRP demonstrated considerable effectiveness. Our experience under this contract indicated the way toward both improvements to the system and more effective and economical information system design for the PSRO.

The potential for cost savings and improvement in quality of care seemed to be very large if AUTOGRP could be integrated properly into the operating structure of a PSRO. As a result of our experience under the previous contract, the following capabilities were identified as essential for effective data processing and data analysis:

1. local control of data entry and error correction,
2. rapid updating of master files,
3. ability to extend records based on special studies,
4. rapid and flexible access to data,
5. retrieval and analysis of data according to complex specification of criteria,
6. quick generation of special and required reports from their database.

All of these capabilities can be provided by the proper integration of AUTOGRP with standard and efficient data processing procedures.

OBJECTIVES AND SCOPE OF WORK

The objectives under contract HCFA 500-77-0043 with HSQB were 1) to modify and extend the existing AUTOGRP software, 2) to give continued support and assistance to the PSROs in the use of AUTOGRP and the DRGs, and 3) to evaluate different approaches to data entry and master file creation, integrated as effectively as possible with AUTOGRP to provide the above functions. Enhancements and assistance provided under the first and second objectives would support capabilities that facilitate and extend data analytic techniques which PSROs require in the discharge of their responsibilities as regards concurrent review, profile analysis, and MCE studies. The purpose of the third objective was to provide information that would enable PSROs to select optimum data processing and information systems which would allow them to perform their functions in the most cost effective manner given the current and expected future states of computer hardware and software technology.

To meet these objectives, the scope of work under this contract included:

1. modifying and extending AUTOGRP capabilities in order to improve its ability to store, retrieve, and display data in support of PSRO activities, and to allow production of reports on an interactive as well as batch basis;
2. specifically extending AUTOGRP to support more effectively MCE studies;
3. designing, programming, and installing AUTOGRP based information systems in seven PSROs;
4. comparing alternative configurations in terms of functional capability, costs, and performance so as to determine the most effective configuration in any site; and
5. continuing to provide the necessary support for seven PSRO pilot sites to access their data through the AUTOGRP system and to analyze their data using the 383 DRGs.

The seven pilot sites chosen for this study were the six PSROs participating in the previous project (Central Massachusetts Professional Standards Review Organization, Colorado Foundation for Medical Care, Dade-Monroe Professional Standards Review Organization, Multnomah Foundation for Medical Care, South Carolina Medical Care Foundation, and Wisconsin Professional Review Organization) and the Pasadena Area XVIII Professional Standards Review Organization.

CONTENTS OF THIS REPORT

The purpose of this report is to document the Center's work performed under this contract. It is divided into two part: Part I describes the modifications to AUTOGRP and the application of the system and the DRGs in PSRO activities, Part II contains a description and evaluation of the mini database systems installed at the South Carolina and Pasadena PSROs. Separate sections in Part I contain 1) general background information on PSROs, AUTOGRP, and the DRGs (for readers of this report who may be unfamiliar with any of these areas), 2) a description of the AUTOGRP modifications and extensions provided under this contract, 3) an extensive discussion of the DRGs - their development and applications, the DRG specific case mix reports, the use of those reports in the analysis strategy of individual PSROs, and modifications which would make these reports more useful to PSROs, 4) proceedings of the final User's Forum in which representatives from the PSROs presented summaries of their applications of the system and DRGs, and 5) a concluding discussion of the Center's evaluation of the utility of AUTOGRP and the DRGs in PSRO related research.

PART I

1.0 BACKGROUND AND RATIONALE

Professional Standards Review Organizations (PSROs) were mandated under an amendment to the Social Security Act of 1972 to assure the quality and appropriateness of health care services delivered to federally funded patients (Medicare, Medicaid, Title V) [3]. Specifically, PSROs are responsible for the conduct of three interrelated review functions:

1. Concurrent Review including
    a. Admission Certification
    b. Continued Stay Review
2. Medical Care Evaluation Studies
3. Profile Analysis

In the case of the concurrent review function, admission certification and continue/ stay review assure the necessity for admission and continued stay in the hospital, respectively. Once admission is certified an initial checkpoint based on the specific condition of the patient is assigned, at which time the patient will be reviewed for certification of continued stay. Most often, the PSRO will use general length of stay norms for a large geographic area to assign the initial length of stay checkpoint (frequently the 50th percentile). While concurrent review is mainly concerned with establishing appropriate utilization practices, medical care evaluation (MCE) studies are conducted as in depth investigations into the quality of health care services. A mechanism for identifying topics for MCEs is through profile analysis. Profile analysis is directed toward identifying areas of significant variation from expected patterns of health care services across both institutions and providers.

Each of the above functions requires specific data related to the patient and his hospital stay. These data are primarily derived from hospital records. The amount of data collected by a PSRO varies according to its size and specific activities, but typically it is often in the tens of thousands for any given year. In order for PSROs to monitor the quality and utilization of health care services for patients within their purview of responsibility, efficacious mechanisms for analyzing these data must be made available.

For the past nine years, researchers at the Center for Health Studies at Yale University have worked at developing, under grants and contracts from the federal government, an interactive computer system called AUTOGRP, designed to facilitate analyses of complex medical information. It provides the facilities for information retrieval in the form of data displays, reports, graphic displays, and descriptive statistical analyses. The AUTOGRP command language combines several underlying computer programs into a single unified language composed of readily comprehensible expressions which are easily learned by users with or without a prior mathematical or computer programming background.

A major component of the system is the capability to define homogeneous classes or groups of patient records on the basis of some sets of independent attributes. This has important applications in the operation of a patient care monitoring system where one must be able to identify, based on process measures, incidents of care for which patient management decisions appear to produce unexpected results. If, for example, bed days consumed is employed as one of these measures, then one must be able to predict bed days required by each patient. This necessitates the identification of some set of patient attributes (e.g. diagnoses, age, complications) to allow for stability in such predictions. For this purpose, AUTOGRP provides a clustering algorithm that suggests groupings of observations which maximize explained variance in values of the dependent variable. A clinician at the Center used AUTOGRP to interact with a representative database of hospital discharge summaries to construct a patient classification scheme composed of Diagnosis Related Groups (DRGs) for length of stay. This scheme is based on a procedure referred to as the "significant attribute method," which defines groups of patients on the basis of particular variables that have demonstrated a strong effect in determining length of stay. The selection of these variables was determined by application of the clustering algorithm to the database.

As described above, the AUTOGRP System and its associated patient classification scheme are both powerful and efficient mechanisms for patient care monitoring with immediate applications to the data analysis problems faced by PSROs. The analytic and investigatory processes performed by PSROs in discharging their responsibilities are iterative in nature, requiring sequential sets of information (individual records, counts, averages, percentiles) in a variety of formats (tables, charts, graphs, record dumps, scatter plots). The specification for each set of information is determined after examining the data retrieved on the previous set. The interactive nature of AUTOGRP together with its flexible data retrieval and display capabilities facilitates this iterative process by allowing the user to examine his data both in the aggregate and on a patient-by-patient basis. Turnaround to queries is immediate, thus providing timely response to data needs. The classification scheme provides a structure of consistent class definition within which comparisons of providers and institutional practice can be made with respect to comparable types of patients.

Given the medical meaning of each patient group deviations from expected value on a patient-by-patient basis signal PSROs that such cases should be reviewed to determine appropriateness of care. When problems are detected, they can be easily investigated and followed up using the system.

A comprehensive discussion of the DRGs which form the basis of the patient classification scheme referred to in the above paragraphs is contained in Section 3. Following is a brief overview of the AUTOGRP system and its command language.

THE AUTOGRP SYSTEM

AUTOGRP is an interactive data retrieval and descriptive data analysis system designed to facilitate cost efficient analyses of large databases [4]. Initially, the system was designed as a mechanism for investigating relationships between the demographic and clinical characteristics of hospital inpatients and their consumption of resources. These relationships were expressed as a set of groups formed with a clustering algorithm invoked by the CLASSIFY procedure, one of the system's facilities.

Currently, however, the system is used primarily as an information retrieval and data display system by organizations and research groups with large (over 100,000 records) medical databases. As such, it offers users the capability to access all or parts of their database and display the information in several different formats. AUTOGRP's command language was intentionally designed as a series of English-like readily comprehensible expressions which can be easily learned by users regardless of their prior computer programming experience [6]. The commands can be divided into six major areas depending on their function: subgroup creation, descriptive data display, variable recode and creation, report generation, record listing, and record clustering or classification.

AUTOGRP is actually an extension to a general purpose programming language called CML (Conversational Modelling Language) [5]. CML is an interactive algorithmic language similar to PL/1 in which statements may be executed interpretively or partially compiled into programs. One facility provided by CML is a mechanism by which a programmer may "extend" the CML language set. That is, the programmer may define his own set of commands which, when interfaced with the CML system programs and structures, provide a system suitable to his unique programming needs.

If the user's dataset does not meet the database structure requirements of AUTOGRP, it may be reorganized in a two stage process applying two other CML extensions - VCS (The Variable Conversion System) and AUTOSEL [1]. VCS provides a means by which a database containing card image data may be used to produce a "converted" database, with all numeric variables transformed to either integer or floating point binary representation.

Once the entire database has been converted with VCS, the user invokes AUTOSEL to create a direct access disk subfile containing only the subset of records and variables required for the analysis. This is a two step process. First, the user interactively enters the necessary information that specifies the subfile, and appropriate job control is constructed. Second, the job control is submitted for batch processing and a file formed according to the specifications in Step 1. These subfiles may then be analyzed with either AUTOGRP or SAS [2].

THE COMMAND LANGUAGE

The AUTOGRP command language allows one maximum flexibility in examining a database by providing a number of descriptive and data retrieval commands that may reference all or a subset of the observations in a database. The commands can be divided into six major areas depending on their function:

1. Subset Creation
2. Descriptive Data Display
3. Variable Creation
4. Report Generation
5. Record Listing
6. Record Clustering or Classification

An overview of the commands in each of the major areas is given in the following paragraphs. While it is not an exhaustive presentation of all the commands available in AUTOGRP, it highlights the major capabilities of the system. A complete description of the commands can be found in the AUTOGRP Reference Manual [6].

Subsets of the database can be formed and subsequently analyzed using the commands GROUP, COMBINE, and REMOVE. GROUP will form and name a subset from the entire database or a previously defined subset based on the values which specific variables attain. For example, the GROUP command will allow formation of a subset of observations named "old" which contains only patients from the entire database who were over age 65:

```
group old = * w.e age >65
```

The "*" indicates the subset old is to be formed from all observations in the database, and the "w.e" is an abbreviation for "which are." Thus, the subset "old" will contain all observations in the database which have values for the variable age over 65. This subset may then be operated on by subsequent commands. COMBINE allows new subsets to be formed which are composed of observations based on the union, intersection, or exclusion of already existing subsets. For example,

```
comb a = b, c          (union)
comb d = b w.e c       (intersection)
comb e = b without c   (exclusion)
```

where b and c are already existing groups or subsets. The REMOVE command will redefine the observations which make up an existing subset by eliminating specific observations (e.g. eliminating all males). For example,

```
remove sex = 1 from old
```

If desired, the definition of subsets may be saved and restored between AUTOGRP sessions using the SAVE and RESTORE commands, respectively. Or, they may be deleted entirely during any session using the UNLOAD command.

Once subsets have been formed, several commands will display their characteristics. The DISPLAY command will display the number of observations and the mean and standard deviation of a dependent variable for each value of an independent variable. The results of the DISPLAY command can be ranked in the order of number of observations, values of the independent variable, mean of the dependent variable. The STATS command will calculate the number of observations, mean, standard deviation, skewness, kurtosis and minimum and maximum values for a specific subset and variable. Histograms of the dependent variable for any subset can be generated using the HIST command. PROFILE allows one to produce profiles of patients in a specified group on the basis of any independent and dependent variables. This command generates the inter quartile range of the dependent variable for each value of the independent variable, and in addition provides the sample size, mean, standard deviation, median, and any defined labels. For comparative purposes, identical statistics are also computed for the group as a whole and displayed.

The VAR command will allow new variables to be created from existing variables using a large set of arithmetic, functional, or logical transformations. Value definitions can be assigned to user created variables through issuance of the DEFINE statement. The new variable definitions may be stored and used in subsequent sessions.

Report generation facilities exist in AUTOGRP for producing a variety of reports, ranging in complexity from a simple list of the values of some variables, to multidimensional cross-tabulations and statistical tables. A sequence of SEARCH, ORDER, REPORT, and END statements will produce a report which is automatically sorted and formatted. The TYPE statement can also be used to generate reports, but formatting is not automatic.

The PRINT command will list the values of specified variables for all observations in a subset. Output appears in fixed formatted columns, and headings with variable names are printed. Thus, "record dumps" can be produced. For example,

```
print dx1, dx2, los, dstat of * w.e physid = 3742
```

will generate a list of primary diagnosis, secondary diagnosis, length of stay, and discharge disposition values, all corresponding to cases in the database which have a value of 3742 for physid (i.e. all cases seen by a particular physician).

The CLASSIFY command implements an algorithm which near optimally partitions the observations of a subset into a small number of subgroups according to the values of an independent variable so that unexplained variance in a specified dependent variable is minimized. This facility allows a user to construct meaningful partitions of the database, which explain the behavior of some measure of interest. RESULTS provides a summary of the subgroups recommended by a CLASSIFY, for a specified independent variable, and DETAILS provides a cell by cell description of these groups.

References

[1] AUTOSEL: An AUTOGRP Subfile Creation Utility. Yale University, Institution for Social and Policy Studies, Center for Health Studies, 1978.

[2] Elia, R. and Freeman, J., AUTOGRP/SAS Interface. Yale University, Institution for Social and Policy Studies, Center for Health Studies, 1978.

[3] Goran, Michael J., Roberts, James S., Kellogg, Meg A., Fielding, Jonathan, and Jessee, William, The PSRO Hospital Review System, Medical Care, Vol. 13, No. 4, Supplement, 1975.

[4] Mills, R., Fetter, R., Riedel, D., Averill, R., AUTOGRP: An Interactive Computer System for the Analysis of Health Care Data, Medical Care, Vol. 14, pp. 603-615, 1975.

[5] Mills, R., Fetter, R., Averill, R., CML User's Manual. Yale University, Institution for Social and Policy Studies, Center for Health Studies, 1978.

[6] Theriault, K., Mills, R., Elia, E., The AUTOGRP Reference Manual. Yale University, Institution for Social and Policy Studies, Center for Health Studies, 1979.

2.0 AUTOGRP EXTENSIONS AND MODIFICATIONS

Several extensions and modifications of the AUTOGRP software were identified under the previous contract by the six PSRO test sites as areas in which the system could be further expanded to make it more effective in PSRO activities. These facilities include:

1) Greater flexibility in creating subfiles of the database

2) Additional capabilities for descriptive analyses for use in profiling and identification of MCE studies

3) Extension of statistical capabilities

Developments were prioritized in the order of anticipated impact on overall data analysis activities and cost reduction. Thus, the tasks in this area were performed in roughly the same order as listed above.

2.1 GREATER FLEXIBILITY IN CREATING SUBFILES OF DATABASE

The cost of storing and analyzing datafiles is a function of their size - the number of observations and number of variables recorded for each observation. In the processing of such files it is therefore efficient to conserve computer resources and process only those records and variables directly involved with the analysis to be performed. For example, suppose one has a database of 100,000 records representing discharge summaries from several hospitals, and he wants to retrieve some demographic information - age, sex, race - on the patients discharged from a specific institution. Then, to supply this information the computer needs to process only records from that hospital and construct statistical displays using the three variables of interest - age, sex, race. This reduced group of records with the subset of variables is referred to as a "subfile" of the master file, which contains all 100,000 records or observations.

AUTOSEL is a utility developed to create such subfiles, which will subsequently be analyzed using the AUTOGRP interactive analysis package[1]. AUTOGRP requires a direct access binary disk file, which AUTOSEL creates from a sequential dataset. It is a two stage procedure. During the first stage the user interactively enters the necessary information that specifies the subfile. This information is then stored by the computer and appropriate job control constructed that will instruct the system to access the master file and create the subfile. In the second stage, the user submits this job control for batch processing, and the file is constructed according to the user's specifications. While one incurs a certain cost subsetting the master file prior to analysis, it is generally advantageous to do so when one is conducting extensive or repeated analyses on the data. It is a necessity when the computer installation does not have adequate disk storage space to hold the entire file.

Before executing AUTOSEL one must have a clear definition of the subfile required for his analysis. That is, he must be prepared to specify:

1) a criteria that accurately describes the subset of records to be selected from the master file; and

2) a list of variables to be included on each record

In addition, he must have some estimate of the number of records his subfile will contain. Optionally, he can designate the dependent variable and change some job control keywords. This information is supplied to AUTOSEL either directly or through system prompts. Moreover, appropriate commands allow the user to display the information he has transmitted and to correct it if necessary.

AUTOSEL was made available to the PSRO sites in February 1978 and greatly extended their capability to retrieve and analyze information from their databases.

In addition, it resulted in reduced costs (30 - 50 percent reduction) for creating subfiles as compared to the previous facility - SELSET. Moreover, many of the technical difficulties users had with learning and using SELSET have not been reported with AUTOSEL. To the contrary, users have indicated it is a much easier utility to implement, with fewer errors made at execution.

2.2 ADDITIONAL CAPABILITIES FOR DESCRIPTIVE ANALYSES

In their evaluations of the AUTOGRP system, PSRO users have repeatedly indicated that the system's major advantages as a data analysis tool are flexible facilities for information retrieval and descriptive data display. They have suggested a number of ways existing commands could be modified and how new extensions might be designed to make the system more effective in meeting their analysis needs. Under the Center for Health Studies' current contract with HSQB AUTOGRP modifications were made in both these areas.

Modifications to the Descriptive Capabilities of Existing AUTOGRP Commands

The descriptive capabilities of several existing AUTOGRP commands were modified as itemized below.

1. The DISPLAY Command

The DISPLAY command was modified to allow for the printing of longer (8 character) character variable values.

2. The GROUP and COMBINE Commands

AUTOGRP groups may be created with either a "GROUP" or "COMBINE" command. The command string used to create the group is now saved. It will be displayed when a GROUP is "EXPLAINED," "SAVED" OR "RESTORED." Examples:

```
==>group a=* w.e los<40
A CONTAINS 1263 OBSERVATIONS
==>group b=a w.e age<65
B CONTAINS 978 OBSERVATIONS
==>group c=b w.e "dstat 0,2,4,6,8,10"
C CONTAINS 537 OBSERVATIONS
==>
==>explain groups
A CONTAINS 1263 OBSERVATIONS
GROUP A=* W.E LOS<40
B CONTAINS 978 OBSERVATIONS
GROUP B=A W.E AGE<65
C CONTAINS 537 OBSERVATIONS
GROUP C=B W.E "DSTAT 0,2,4,6,8,10"
==>
==>save g a,b,c
==>
==>quit
GROUPS,DIST,USERVARS SAVED?>y
READY

agrp7
CML7.3 - JULY 10, 1978
==>exec demol
AUTOGRP, VERSION 7.6.  SEPT. 30, 1978
==>
==>reso@tore g a,b,c
A CONTAINS 1263 OBSERVATIONS
B CONTAINS 978 OBSERVATIONS
C CONTAINS 537 OBSERVATIONS
==>
==>explain groups
A CONTAINS 1263 OBSERVATIONS
GROUP A=* W.E LOS<40
B CONTAINS 978 OBSERVATIONS
GROUP B=A W.E AGE<65
C CONTAINS 537 OBSERVATIONS
GROUP C=B W.E "DSTAT 0,2,4,6,8,10"
==>
```

3. The PRINT Command

A "BY" option was added to the PRINT Command. This option causes output to be sorted on one or more variables. The syntax of the PRINT Command has been changed to:

PRINT {AEXPRN} $^{\{,\}}$ OF GROUPDEF [BY AEXPRN] $^{[,]}$

To sort on more than one variable, the variables to be sorted must be printed consecutively. That is, the variables in the "BY AEXPRN" list must be in the same order as in the "PRINT AEXPRN" list, and in both AEXPRNS, these variables must be contiguous. For example,

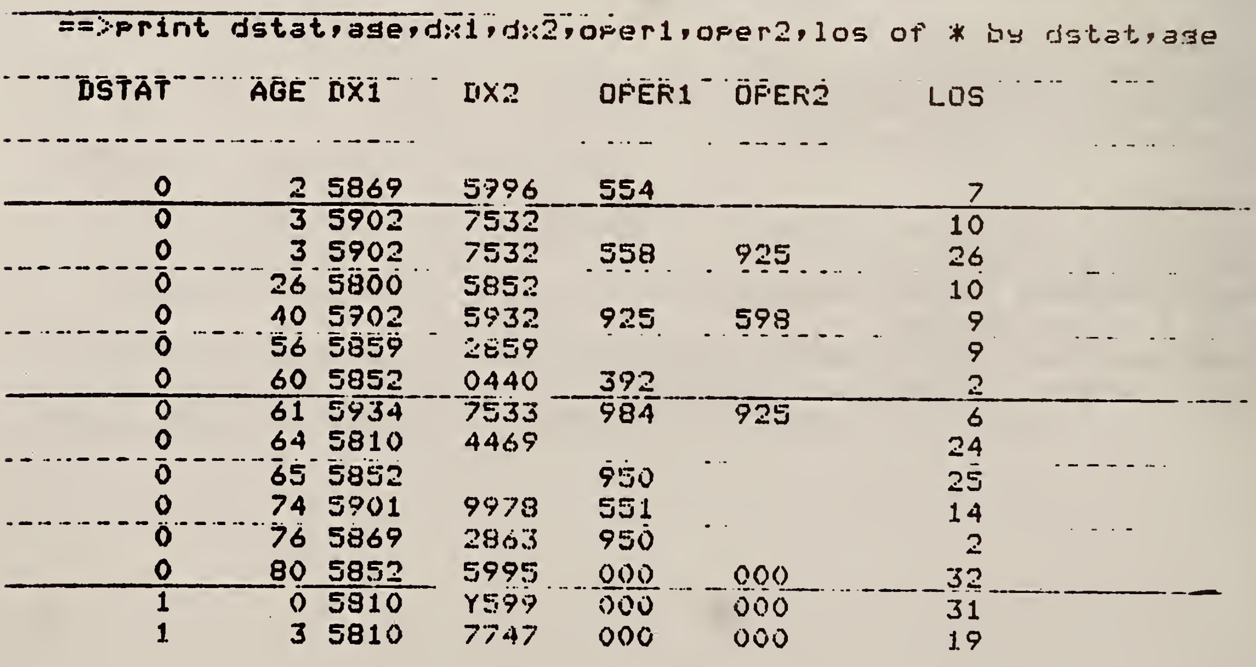
```
PRINT, AGE,SEX,DX1,DX2,OP1,OP2,DSTAT OF * BY DX1,OP1
```

will not sort on dx1 and op1 because these variables have not been printed contiguously. The following command, however, would sort on these two variables.

```
PRINT AGE,SEX,DX1,OP1,DX2,OP2,DSTAT OF * BY DX1,OP1
```

To allow for ordered printouts, extensive modifications were made to "PRINT." Due to these changes, the number of observations which can be printed has been somewhat limited.

Example: PRINT command sorted on more than one variable



```
  ==>print dstat,age,dx1,dx2,oper1,oper2,los of * by dstat,age

   DSTAT      AGE DX1     DX2     OPER1  OPER2     LOS


       0        2 5869    5996    554                7
       0        3 5902    7532                      10
       0        3 5902    7532    558    925        26
       0       26 5800    5852                      10
       0       40 5902    5932    925    598         9
       0       56 5859    2859                       9
       0       60 5852    0440    392                2
       0       61 5934    7533    984    925         6
       0       64 5810    4469                      24
       0       65 5852            950               25
       0       74 5901    9978    551               14
       0       76 5869    2863    950                2
       0       80 5852    5995    000    000        32
       1        0 5810    Y599    000    000        31
       1        3 5810    7747    000    000        19
```

4. SEARCH-ORDER-REPORT

SEARCH-ORDER-REPORT was altered so that the user can chose the column width to be printed by this command. A new AUTOGRP variable, COLSIZE has been added to indicate the width of each column. To use COLSIZE, the following is done:

Add to the "ENTITY ABEXT" statement

```
..., COLSIZE I.4 at 72
```

Use the standard CML assignment statement to change the default value

```
COLSIZE=12
```

The default for "COLSIZE" is 8. Any practical column width is acceptable.

The "MAXCOLS" variable was also changed. It no longer represents the number of columns that will fit on one line, but the number of print positions. The default for "MAXCOLS" is 120, which is the standard print length for Decwriter terminals.

As an example of the use of "MAXCOLS" and "COLSIZE"

```
==> COLSIZE=12
==> SEARCH *
==> ORDER SEX
==> REPORT COUNT, DIST ROW, COL, ALL DSTAT
==> END
```

```
---------------------------------------------------------------------------------------------
                          DSTAT        DSTAT        DSTAT        DSTAT        DSTAT
SEX        COUNT              0            1            2            3            4

              4               0            0            0            0            4
                           .00%         .00%         .00%         .00%      100.00%
                           .00%         .00%         .00%         .00%         .32%
---------------------------------------------------------------------------------------------
                           .00%         .00%         .00%         .00%         .31%

 F          487               4            1            3            1          478
                           .82%         .21%         .62%         .21%       98.15%
                         30.77%        9.09%       30.00%       50.00%       38.18%
                           .31%         .08%         .23%         .08%       37.11%
---------------------------------------------------------------------------------------------
 M          797               9           10            7            1          770
                          1.13%        1.25%         .88%         .13%       96.61%
                         69.23%       90.91%       70.00%       50.00%       61.50%
                           .70%         .78%         .54%         .08%       59.78%
---------------------------------------------------------------------------------------------
TOTAL      1288              13           11           10            2         1252
                          1.01%         .85%         .78%         .16%       97.20%
                        100.00%      100.00%      100.00%      100.00%      100.00%
                          1.01%         .85%         .78%         .16%       97.20%
```

SEARCH-ORDER-REPORT has also been modified so that the order variables will be repeated when there are too many columns to fit on one page and printing continues to successive pages. An example of this printing procedure follows.

```
[illegible]
==>
==>search some
==>order sex
==>report count,per,mean los,tot los,ptot los,dist row,col dowad
==>end

                                         MEAN        TOTAL        % TOT        DOWAD
      SEX       COUNT     PERCENT         LOS          LOS          LOS            1

                    2       2.00%        1.00            2        1.35%            0
                                                                                .00%
                                                                                .00%

        F          26      26.00%        1.62           42       28.38%            0
                                                                                .00%
                                                                                .00%

        M          72      72.00%        1.44          104       70.27%            0
                                                                                .00%
                                                                                .00%


    TOTAL         100     100.00%        1.48          148      100.00%            0
                                                                                .00%
                                                                                .00%



                DOWAD       DOWAD       DOWAD        DOWAD        DOWAD        DOWAD
      SEX           2           3           4            5            6            7

                    0           0           0            1            1            0
                 .00%        .00%        .00%       50.00%       50.00%         .00%
                 .00%        .00%        .00%        5.56%        5.56%         .00%

        F           0          25           0            1            0            0
                 .00%      96.15%        .00%        3.85%         .00%         .00%
                 .00%      89.29%        .00%        5.56%         .00%         .00%

        M          35           3           0           16           17            1
               48.61%       4.17%        .00%       22.22%       23.61%        1.39%
              100.00%      10.71%        .00%       88.89%       94.44%      100.00%

    TOTAL          35          28           0           18           18            1
               35.00%      28.00%        .00%       18.00%       18.00%        1.00%
              100.00%     100.00%        .00%      100.00%      100.00%      100.00%


==>
```

5. The SCATTER Command

SCATTER plot has been modified to include a labeling of the axes.

6. User Variables

The command string used to create a USERVAR can now be saved. This information will be displayed whenever a USERVAR is "EXPLAINED."

To save a USERVAR the syntax is

```
SAVE U {NAME} [,]
```

To RESTORE

```
RESTORE U {NAME} [,]
```

"SAVED" USERVARs are written to the user's library, just as groups and distributions are. They will be written using the USERVAR's name as a FILENAME and with a FILETYPE of ".OBJ".

New Extensions for Descriptive Analyses

A new capability for profile analysis was added to AUTOGRP. Existing formats in AUTOGRP for profile displays were all univariate in nature. That is, several profile subjects were compared to each other and the overall group on the basis of a single variable or measure (e.g. average length of stay). While this greatly enhanced the PSRO's capabilities to examine patterns across multiple subjects with respect to one measure of performance, recommendations were made by two sites, the Colorado Foundation for Medical Care (CFMC) and the Multnomah Foundation for Medical Care (MFMC) to extend this facility to handle "multivariable" profiles. A multivariable profile presents for each member of a set of profile subjects (e.g. for each hospital in the PSRO region), a comparison of its performance to that for the entire set on the basis of several variables or measures (e.g. average length of stay, death rate, surgical rates) for a specific patient group.

While different display formats were used by the two organizations (CFMC and MFMC), there were many similarities in terms of the three fundamental components - patient group, profile subject, profile element - that define a profile. Both approaches were examined and a set of specifications developed and implemented for a facility to automate the construction and display of these profiles.

This facility has certain key attributes which were felt to be essential for the user to analyze his data effectively. First of all, it is available on an interactive basis, in AUTOGRP, with the user able to specify the patient group, profile subjects, and profile elements based on criteria defined with variables from his database. Second, the types of profile elements have been extended to include other measures besides the mean and median values of variables. For example, other relevant measures are in the form of rates and proportions. Finally, the information is displayed in a visually effective way in order to highlight aberrant patterns, thus facilitating their identification. This facility is called COMPARE and is discussed at length in Interactive Multivariable Profile Analysis [2]. We include here an overview of COMPARE's syntax and display format.

The COMPARE facility is a variation of search-order-report with the following syntax:

```
SEARCH           profile group

ORDER            profile subject [,{iterating variables}[,]]
                ⎧⎧                 ⎫                          ⎫
                ⎪⎪ avg             ⎪  {,}                     ⎪  [,]
                ⎪⎪ ratio           ⎪                          ⎪
                ⎪⎪ median          ⎪                          ⎪
COMPARE         ⎨⎨ sum             ⎬  ({AEXPRN [TO AEXPRN]})  ⎬        [without]
                ⎪⎪ var             ⎪                          ⎪
                ⎪⎪ rate            ⎪                          ⎪
                ⎪⎩                 ⎭                          ⎪
END             ⎩                                             ⎭
```

The SEARCH statement specifies the profile group which defines the scope of the profile in terms of the population to be analyzed (e.g. all females over age 30 with a hysterectomy). The ORDER statement specifies the level of profile subjects requested. For example, if an individual profile subject is to be a hospital (AUTOGRP name is hosp), then the user would enter:

```
order hosp
```

If an additional dimension is of interest for each profile subject, e.g. a time dimension for each hospital, then the user would enter:

```
order hosp, qrtr
```

where qrtr is a variable name representing the quarterly time period. In the COMPARE statement, the user specifies the profile elements he wants generated. For example, the statement

```
compare median(los) rate(dstat=8) ratio(tdapp to los)
```

generates for each profile subject (or level of profile subject if more than one iterating variable is used in ORDER), the median length of stay (los, the death rate (dstat=8), and the ratio of total days approved (tdapp) to total length of stay.

The display format used by COMPARE is illustrated in an example on the following page. This "wedge and bar" format was developed by CFMC. In this format for each profile subject a series of grids is produced corresponding to each profile element requested in COMPARE. The grid contains a bar whose length and position in the scale of the grid represents the interquartile range of the profile elements corresponding to either:

1) the entire set of subjects in the patient group, or
2) the set of subjects in the patient group <u>without</u> that particular subject

```
==>de[illegible]ne transfer from 0 to 1
==>define outlyer from 0 to 1
==>define emergent from 0 to 1
==>
==>search *.w.e drg=121
==>order hosp
==>compare med(los) rate(los>45 like outlyer) med(age) rate(dstat=7 !
==>like dstat,atype=1 like emergent,'dstat 3,5' like transfer) without

==>end
PROFILE SUBJECT: HOSP G SUBJECT COUNT= 23 GROUP COUNT= 1986

             10.50     11.50     12.50     13.50     BY= .1
            :+---------+---------+---------+---------:  MEDIAN     25TH     50TH     75TH
LOS              V                                     11.00
                 ===============================                  11.00    12.75    14.00


             -.4       1.0       2.5       4.0       BY= .15
            :+---------+---------+---------+---------:    RATE     25TH     50TH     75TH
OUTLYER                                    V                4.35
                ========                                           .09      .64     1.15


             65.0      67.5      70.0      72.5      BY= .25
            :+---------+---------+---------+---------:  MEDIAN     25TH     50TH     75TH
AGE                                        V               73.00
                 ===============                                  66.25    68.25    69.75


             10        25        40        55        BY= 1.5
            :+---------+---------+---------+---------:    RATE     25TH     50TH     75TH
DSTAT                                 V                    47.83
                 =======                                          17.77    22.13    27.29


             -7        17        42        67        BY= 2.5
            :+---------+---------+---------+---------:    RATE     25TH     50TH     75TH
EMERGENT       V                                             .00
                          ====================                    28.35    60.64    75.72


             1.60      2.60      3.60      4.60      BY= .1
            :+---------+---------+---------+---------:    RATE     25TH     50TH     75TH
TRANSFER                               V                    4.35
                 ============================                      2.06     4.40     5.04
```

A letter "v" (wedge) is used to indicate the value of the subject's profile element. The range and interval of each grid's scale is calculated by an algorithm which seeks to center the wedge and bar in the middle 75 percent of the display.

To the left of the grid is information identifying the profile element. Above the grid is information identifying the profile subject, the number of observations in the subject's patient group and the number of observations in the overall patient group. To the right of the grid is the value for that subject's profile element and the 25th , 50th, 75th percentiles for the set of profile elements corresponding to all (or all other) subjects.

The example included here is a portion (one institution) of the output produced when multivariable profiles were generated for institutions on patients with A.M.I.'s. The profile elements are median length of stay, percent outlyers, median age, death rate, percent emergent admissions, and percent discharged to another facility. The SEARCH statement specifies the patient group - all observations in DRG 121, which is the Diagnosis Related Group number for A.M.I.'s. Profile subjects are defined as individual hospitals in the ORDER statement. Note the "without" option is used to indicate that interquartile ranges of elements in the patient group should be calculated after excluding the element corresponding to the individual subject being compared. In this instance with respect to the other institutions, the hospital has a very high death rate (48 percent), with typically low lengths of stay (11 days) for its cases. There were no emergent admissions and the referral pattern (4 percent transferred) to other facilities is not out of line with the other subjects. While the hospital appears to treat an older (73 years of age) population, it is highly questionable whether a five year differential in this age range for A.M.I.'s is indicative of a more complex case. To be sure, the number of observations is low (23 cases), but this pattern may be indicative of a quality of care problem in this subject's area.

With respect to the utilization of univariate and multivariate profiles, it clearly depends on the user's objectives. One uses univariate profiles when he wants to compare the performance of multiple profile subjects with respect to one measure. However, when several comparisons of a specific subject to the overall set of subjects are of interest, then multivariable profiles are appropriate for summarizing the data. In many instances, multivariable profiles provide supportive information as followups to an aberrant pattern(s) detected in a univariate profile. For example, if an analyst examines an institutional length of stay profile for a specific operative group and notes wide variation among hospitals, he may seek to determine the reasons by generating multivariable profiles with elements that may serve to explain the differences. Such elements could be average preoperative length of stay, median age, surgical complication rate, percent of cases with multiple diagnoses, and percent of cases with multiple procedures.

Multivariable profiles may also be used, as in the cases of the Colorado Foundation for Medical Care and the Multnomah Foundation for Medical Care to identify problem areas where a subject is observed to exhibit especially deviant patterns from others in the group. The particular format facilitates feedback of information to subjects, for it not only presents how he has performed, but how he has performed relative to others. Moreover, when run on a routine basis they can serve as ongoing monitoring mechanisms of the overall system, particularly previously identified problem areas. An extensive discussion of the application of this facility is included in CFMC's presentation at the User's Forum, Section 4.

2.3 EXTENSION OF STATISTICAL CAPABILITIES

The extension of AUTOGRP's statistical capabilities involved the modification of existing AUTOGRP commands, as well as the addition of new procedures. These modifications and additions are described below.

Modifications to the Statistical Capabilities of Existing AUTOGRP Commands

Several modifications were made to the statistical capabilities of existing AUTOGRP commands. A description of these modifications follow.

1. The DETAILS Command

A one-way analysis of variance (ANOVA) was appended to the DETAILS command. The treatment groups in this ANOVA correspond to the subgroups recommended by CLASSIFY. The option to print this ANOVA table is:

"WITH A"

The new syntax of the DETAILS Command is:

```
                                    {,}
{DETAILS}  [OF NAME]  [FOR]  {NAME}      [WITH [ANOVA]]
```

Example:

```
==>details dx1 with a

 24 CELLS    TSS= 119837  OBSERVATIONS= 1288
  4 GROUPS   TSS= 104364  PCT.REDUCT=  12.9%

*** SIZE= 940    MEAN= 3.93511    SD= 8.38103    SSQ= 65957   ***
           SIZE        MEAN        INDEP VAR
   1        928        3.92        5852       CHRONIC RENAL FAILURE
   2          1        4.00        5938       HYDROURETER
   3          1        5.00        5860       SALT-LOSING NEPHRITIS
   4          7        5.29        5800       ACUTE GLOMERULONEPHRITIS
   5          3        5.33        5820       CHR GLOMERULONEPHRITIS

*** SIZE= 124    MEAN= 7.66126    SD= 6.88809    SSQ= 5835.82   ***
           SIZE        MEAN        INDEP VAR
   6          1        6.00        5932       RENAL PAPILLARY NECROSIS
   7          7        6.57        5939       URETERAL DISEASE NEC
   8         15        6.80        5910       HYDRONEPHROSIS
   9         12        7.67        5830       GLOMERULONEPHRITIS NOS
  10         49        7.73        5902       PYELONEPHRITIS NOS
  11         40        8.13        5934       SOLITARY CYST OF KIDNEY

*** SIZE= 151    MEAN= 10.3508    SD= 9.12246    SSQ= 12482.9   ***
           SIZE        MEAN        INDEP VAR
  12         19        9.05        5869       FUNCT RENAL DISORDER NEC
  13         19        9.37        5937       VESICO-URETERAL REFLUX
  14         34        9.53        5810       NEPHROTIC SYNDROME
  15         21        9.67        5901       ACUTE PYELONEPHRITIS
>>.


                       ANALYSIS OF VARIANCE
  ==================================================================
   SOURCE       D.F.           S.S.         M.S.        RATIO
   BETWEEN        3         15473.56      5157.85      63.458
   WITHIN      1284        104363.94        81.28
               ======================================
               1287        119837.50        93.11

 F = 63.458 WITH 3 AND 1284 D.F.

 P < .0001
```

2. The DISPLAY Command

A one-way analysis of variance (ANOVA) has also been appended to the DISPLAY command. To request an ANOVA, the keyword "ADISPLAY" is used instead of the keyword "DISPLAY."

Syntax: adisplay {AEXPRN} {,} $\left\{\begin{array}{l}\text{of}\\ \text{in}\\ \text{for}\end{array}\right\}$ GROUPDEF

In this ANOVA the treatment groups correspond to the levels or categories of the independent variable being displayed. Example:

```
==>adisplay sex of *

--------------------------------------------------------------------------
        NUMBER                  MEAN         S.D   SEX
          OBS.       PCT         LOS         LOS   CODE
--------------------------------------------------------------------------
           487    37.81%         6.99       10.57    F
           797    61.88%         5.05        8.99    M
--------------------------------------------------------------------------

                             ANALYSIS OF VARIANCE
--------------------------------------------------------------------------
       SOURCE        D.F.             S.S.          M.S.        RATIO
       BETWEEN          1          1135.27       1135.27       12.270
       WITHIN        1282        118619.06         92.53
--------------------------------------------------------------------------
                     1283        119754.37         93.34
--------------------------------------------------------------------------
     F = 12.270 WITH 1 AND 1282 D.F.
--------------------------------------------------------------------------
     P = .0012
```

3. The DSTAT Command

The DSTAT command was syntactically modified to allow users to enter an actual confidence level instead of a code. The new syntax is like the old except the "NUM" entered should be one of the following:

50 68 75 80 85 90 95 97.5 99 99.9

In the following example a confidence level of 97.5 is specified.

```
==>dist dlos=*
==>
==>dstat 97.5 dlos

                     DESCRIPTIVE STATISTICS

SIZE                                                    1288
MEAN                                                   5.769
STANDARD DEVIATION                                     9.650
COEFFICIENT OF RELATIVE VARIATION (%)                167.276
VARIANCE                                              93.113
STANDARD ERROR OF MEAN                                  .269
CONFIDENCE INTERVAL OF MEAN (97.5%)          5.18518<M<6.35209
SKEWNESS                                               3.358
KURTOSIS                                              14.352
```

The DSTAT Command was also modified to drop the calculation of standard errors and confidence intervals for the standard deviation, skewness, and kurtosis. DSTAT continues, however, to report the standard error and confidence intervals for the mean.

4. The PTILE Command

The QTILE Command was replaced by a more general command PTILE which allows the user to specify up to 20 percentiles for the dependent variable of some distribution or group. This command is an extension to the "HIST" syntax, as follows:

PTILE {NUM} $^{\{,\}}$

"NUM represents any percentile between 1 and 99. Real numbers (such as PTILE 85.5) are allowed. Example:

```
==>dist dlos = *
==>
==>ptile 10,25,50,75,80,90,95 dlos

     1288 OBSERVATIONS

       10%        25%        50%        75%        80%        90%        95%
      1.00       1.00       2.00       6.00       9.00      16.00      26.00
```

5. The RESULTS Command

A one-way analysis of variance was appended to the RESULTS Command. The treatment groups in this ANOVA correspond to the subgroups recommended by CLASSIFY. The option to print this ANOVA table is:

"WITH A"

The new syntax of the RESULTS Command is:

RESULTS [of NAME] [FOR] {NAME} $^{\{,\}}$ [WITH [ANOVA]]

Example:

```
==>classify * using age,dx1

NAME                  OBS  NC  NG  REDUC          TSS
DX1                   1288  24   4 12.91%    119837.50

*AGE                  1288  86   7 16.86%    119837.87

==>
==>results age,dx1 with

 86 CELLS    TSS= 119838  OBSERVATIONS= 1288
  7 GROUPS   TSS= 99638.5  PCT.REDUCT=  16.9%

FROM   TO  SIZE     MEAN      SD        SSQ    INDEP VAR
   1   33   241     9.25   10.18   24861.13      0-33
  34   35   131     1.52    2.88    1074.70     34-35
  36   50    78    12.81   11.70   10534.16     36-50
  51   62   297     5.78   10.61   33304.46     51-62
  63   74   497     3.05    5.66   15898.15     63-74
  75   80    27    21.81   19.64   10030.42     75-81
  81   86    17    10.71   15.68    3935.61     82-91

                     ANALYSIS OF VARIANCE
-------------------------------------------------------
  SOURCE      D.F.           S.S.        M.S.      RATIO
  BETWEEN       6        20199.38     3366.56     43.282
  WITHIN     1281        99638.50       77.78
          ------------------------------------
             1287       119837.87       93.11

F = 43.282 WITH 6 AND 1281 D.F.

P < .0001


 24 CELLS    TSS= 119837  OBSERVATIONS= 1288
  4 GROUPS   TSS= 104364  PCT.REDUCT=  12.9%

FROM   TO  SIZE     MEAN      SD        SSQ
   1    5   940     3.94    8.38   65957.00
   6   11   124     7.66    6.89    5835.82
  12   18   151    10.35    9.12   12482.89
  19   24    73    16.68   16.70   20088.29

                     ANALYSIS OF VARIANCE
-------------------------------------------------------
  SOURCE      D.F.           S.S.        M.S.      RATIO
  BETWEEN       3        15473.56     5157.85     63.458
  WITHIN     1284       104363.94       81.28
          ------------------------------------
             1287       119837.50       93.11

F = 63.458 WITH 3 AND 1284 D.F.

P < .0001

==>
```

6. SEARCH-ORDER-REPORT

An option for row, column, and cell percents was added to the SEARCH-ORDER REPORT. For each value of a "DIST" variable, the following may now be obtained: percent of row, percent of column, and percent of total population. Percents are printed by appending the following to the "DIST" option of the "REPORT" command.

```
                {,}
          ┌ROW┐
DIST      │COL│
          └ALL┘
```

```
ROW  - percent of row
COL  - percent of column
ALL  - percent of total population
```

The following is an example of the ROW, COL and ALL options

```
==> SEARCH *
==> ORDER SEX
==> REPORT COUNT, DIST ROW, COL, ALL DSTAT
==> END
```

```
-----------------------------------------------------------------------
                       DSTAT      DSTAT      DSTAT      DSTAT      DSTAT
    SEX     COUNT          0          1          2          3          4
-----------------------------------------------------------------------

                4          0          0          0          0          4
-----------------------------------------------------------------------
                        .00%       .00%       .00%       .00%    100.00%
                        .00%       .00%       .00%       .00%       .32%
                        .00%       .00%       .00%       .00%       .31%

-----------------------------------------------------------------------
      F       487          4          1          3          1        478
                        .82%       .21%       .62%       .21%     98.15%
-----------------------------------------------------------------------
                      30.77%      9.09%     30.00%     50.00%     38.18%
                        .31%       .08%       .23%       .08%     37.11%
-----------------------------------------------------------------------

      M       797          9         10          7          1        770
                       1.13%      1.25%       .88%       .13%     96.61%
                      69.23%     90.91%     70.00%     50.00%     61.50%
-----------------------------------------------------------------------
                        .70%       .78%       .54%       .08%     59.78%

-----------------------------------------------------------------------

  TOTAL      1288         13         11         10          2       1252
                       1.01%       .85%       .78%       .16%     97.20%
                     100.00%    100.00%    100.00%    100.00%    100.00%
-----------------------------------------------------------------------
                       1.01%       .85%       .78%       .16%     97.20%
```

Two additional column options were added to SEARCH-ORDER-REPORT: TOTAL and PTOT.

For each row category, the "TOTAL" option prints the sum of the values of a specified variable across all observations in the row. The "PTOT" option prints the percentage of the overall total that each row total constitutes. These options may only be used on integer or real variables.

An example of the syntax and sample output follow:

```
==> SEARCH *
==> ORDER SEX
==> REPORT COUNT, TOT LOS, PTOT LOS
==> END
```

```
    SEX          COUNT         TOTAL        % TOT
                                 LOS          LOS
--------------------------------------------------
                     4             5         .07%
     F             487          3402       45.79%
     M             797          4023       54.15%

   TOTAL          1288          7430      100.00%
```

A TOTALS row, as shown above, was also added to SEARCH-ORDER-REPORT.

7. <u>The T-Test Command</u>

Owing to the relative obscurity of the Welch Test and Levene Z, these tests were dropped. The visual format of the T-Test has also been changed. Several pieces of information not previously displayed, are now printed. This includes the following: pooled estimate of variance, pooled standard deviation, and standard error of the difference between means. A sample T-Test follows:

Example:

```
==>.gr nosurg=* w.e "oper1 ' '.000'
NOSURG CONTAINS 202 OBSERVATIONS
==>comb surg = * without nosurg
SURG CONTAINS 1086 OBSERVATIONS
==>
==>dist dns=nosurg
==>dist ds=surg
==>
==>ttest dns,ds

                        TWO SAMPLE POOLED T TEST

SAMPLE           SIZE             MEAN             S.D.        VARIANCE

     1         202.00             9.05             9.49           90.04

     2        1086.00             5.16             9.56           91.39

TEST FOR EQUALITY OF VARIANCES:

     F = 1.015          DF = 1085 , 201         P = .4553

ASSUMING VARIANCE EQUALITY:

     POOLED ESTIMATE OF VARIANCE = 91.181

     POOLED STANDARD DEVIATION = 9.549

     STANDARD ERROR OF DIFFERENCE BETWEEN MEANS = .732

     T STATISTIC = 5.318            DF = 1296       P <.0001
```

8. The UTEST Command

Often situations arise when the restrictive assumptions of the T-Test cannot be met. A good nonparametric alternative is the Wilcoxon-Mann-Whitney U Test. Let X_1 and X_2 be samples drawn from two populations. The null hypothesis is that the two populations have identical distributions.

To compute the test statistic, combine observations from both samples (i.e. groups), then rank them in increasing order according to the value of the dependent variable. Then, form U_1 and U_2:

$$U_1 = n_1 n_2 +_1(n_1 + 1)/2 - R_1$$

$$U_2 + n_1 n_2 + n_2(n_2 + 1)/2 - R_2$$

where

n_1 = # obs. X_1
n_1 = # obs. X_2

R_1 = sum of ranks in X_1
R_2 = sum of ranks in X_2

Let U be the minimum or smaller of the values U_1 and U_2. Critical values and, for small enough n_1 exact probabilities are tabulated for given U, n_1, n_2. Refer to standard tables, in general, for n_1, n_2, ≤ 20.

For large n_1, n_2 the distribution of U approaches the normal distribution with

$$\mu_u = n_1\ n_2/2$$

$$\sigma_u = \sqrt{\frac{n_1 n_2 (n_1 + n_2 + 1)}{12}}$$

Hence, one can use the normal approximation for n_1 or $n_2 > 20$:

$$Z = \frac{U - n_1 n_2/2}{\sqrt{\frac{n_1 n_2 (n_1 + n_2 + 1)}{12}}}$$

When observations are <u>tied</u> each is assigned the average of the ranks which would have been assigned had there been no ties. A correction for ties should also be applied to σ_u:

$$\sigma_u = \sqrt{\frac{n_1 n_2}{N(n-1)} \quad \frac{N^3-N}{12} \quad - \Sigma T}$$

$$N = n_1+n_2$$

$$T = \frac{t^3-t}{12}$$

where t is the # of observations tied for a given rank. Usually, the effect of ties is negligible. When the correction is not made, the test is conservative.

A Wilcoxon-Mann-Whitney U Test was added to AUTOGRP. The syntax is

UTEST {DISTNAME} [,]

Example

```
group nosurg = * w.e "oper1 ' ',000"
NOSURG CONTAINS 202 OBSERVATIONS

comb surg from * without nosurg
SURG CONTAINS 1086 OBSERVATIONS

dist dns = nosurg using dowad

dist ds = surg using dowad

utest dns,ds

                  WILCOXON-MANN-WHITNEY U TEST

       SAMPLE              SIZE        SUM RANKS      U STATISTIC

         1               202.00       145540.50         94334.50

         2              1086.00       684575.50        125037.50


                  Z = 3.2388          P = .0006
```

References

[1] AUTOSEL: An AUTOGRP Subfile Creation Utility, Yale University, Institution for Social and Policy Studies, Center for Health Studies, 1978.

[2] Interactive Multivariable Profile Analysis, Yale University, Institution for for Social and Policy Studies, Center for Health Studies, 1978.

3.0 DRG REPORTS FOR CASE MIX ANALYSIS OF HOSPITAL UTILIZATION

3.1 CASE MIX DEFINITION BY DIAGNOSIS RELATED GROUPS (DRGS)

3.1.1 Introduction

The major function of a hospital as an acute care inpatient facility is to provide the diagnostic and therapeutic services required by physicians in the clinical management of their patients. In addition, the hospital also makes available certain hotel and social services such as meals, laundry, and counseling to patients while they are residents at the institution. Considered as an economic entity, the hospital's outputs are the specific services it provides in terms of hours of nursing care, medications, and laboratory tests. Its inputs are the labor, material and equipment used in the provision of these services. Each patient receives a specific set of outputs or services, which is referred to here as a product of the hospital.

For example, consider a patient under treatment for uncomplicated pneumonia. His hospital stay may last six days. Depending on his treatment process, he could receive several chest xrays, a sputum gram stain and culture, a blood culture, several complete blood counts, a urinalysis, routine blood chemistries, two days of oxygen therapy, two days of IV fluids, two days of IV penicillin followed by four days of IM penicillin and a supply of PO penicillin to be taken at home. During his stay, he will also require various amounts and levels of nursing care. This set of outputs constitutes a product ordered by the physician and provided by the hospital to the patient in addition to meals and other hotel services. Each department within the facility consumes a certain amount of inputs in terms of standard labor, material and overhead depending on the output produced. For the radiology department, this would include the films, the technician time, and a portion of the departmental overhead expenses for the equipment and space utilized in the production of the various types of xrays.

Since individual patients receive different amounts and types of services, the hospital may be viewed as a multiproduct firm with a product line that in theory is as extensive as the number of patients it serves. The particular product provided each patient is dependent upon his condition as well as the treatment process he undergoes during his stay. For example, in most instances an ulcer patient with a major surgical procedure such as an exploratory laparotomy or gastric resection requires more units of physician and nursing time, more medication, more ancillary services and remains hospitalized at least ten days longer than a woman admitted for a normal delivery. The former case is generally referred to as more complex since it receives more of the institution's outputs in terms of nursing time, meals, laboratory tests, and special services than the latter case. During any specified time period, an institution admits and discharges a variety of cases representing different levels of complexity. The relative proportions of the different types of cases the hospital treats are collectively referred to as its case mix.

Historically, patient days of care and the number of admissions or discharges have been used to describe hospital output while cost per patient day, percent occupancy and mortality rate have been used to evaluate hospital performance. Such aggregate measures presented out of context of the types of cases treated by an institution and their relative complexity is not particularly useful information to hospital management for internal assessment of efficiency and effectiveness nor to regulatory agencies for inter-institutional comparisons. In particular, the outcome and cost of the individual patient care processes which give rise to the hospital products cannot be adequately determined. As a consequence, administrators and clinicians cannot ascertain the quality and cost implications of the treatment plans practiced within the insitution nor can regulators assess the impact of alternative methods across institutions.

In order to evaluate, compare, and provide relevant feedback regarding hospital performance, it is necessary to identify the specific products which institutions provide. As defined above, a hospital product is a set of services provided to a patient as part of the treatment process controlled by his clinician. While each individual patient admitted to an institution is unique, he has certain demographic, diagnostic, and therapeutic attributes in common with other patients that determine the type and level of services he receives. If these classes of patients with the same clinical attributes and similar processes of care can be identified, then the framework within which to aggregate patients into case types is established. Moreover, if these classes cover the entire range of inpatients in the acute care setting, then collectively they constitute a classification scheme that provides a means for examining the products of the hospital, since patients within each class are expected to receive a similar product.

The means of defining hospital case mix for this purpose is the construction and application of a classification scheme comprised of subgroups of patients possessing similar clinical attributes and output utilization patterns. This involves relating the demographic, diagnostic, and therapeutic characteristics of patients to the output they are provided so that cases are differentiated by only those variables related to the condition of the patient (e.g. age, primary diagnosis) and treatment process (e.g. surgeries) that affect his utilization of the hospital's facilities. These groups or patient classes may then be useful for certain applications in patient care monitoring, budgeting [2], cost control [8,9], reimbursement [21] and planning [5].

Various definitions of case mix and measures of case mix complexity have been proposed and applied by a number of researchers [3,15,17,18,22]. The most frequently applied definition of casemix is based on a patient's primary diagnosis. Primary diagnoses are recorded using either of two coding schemes - the International Classification of Diseases, Adapted for Use in the United States, Eighth Revision (ICDA8) and the Hospital Adaptation of ICDA, Second Edition (HICDA2)[6,13]*. These coding schemes provide a classification of conditions of morbidity and mortality for statistical reporting purposes as well as for information retrieval. Four digit codes are assigned to diagnoses (three digit major category descriptor and a third digit modifier) and three digit codes to surgical procedures (two digit major category descriptor and a third digit modifier).

While partitioning into groups based on diagnosis or ranges of diagnoses alone has benefits in terms of uniform reporting of descriptive statistics about a population, it is not sufficient for defining cases with respect to output utilization. Other variables such as surgical procedures and age of patient in conjunction with diagnosis are necessary to describe adequately sets of patients with similar utilization patterns of inpatient facilities. For example, in one institution examined it was determined that patients with a primary diagnosis in the general category Gastric and Peptic Ulcer (ICDA8 codes 531-5349) with no surgery or complicating secondary diagnoses were hospitalized on the average six days while those with a minor surgical procedure such as endoscopy stayed twelve days, and those with a major surgical procedure and multiple diagnoses stayed twenty-one days. Moreover, the first and second sets of patients incurred only thirteen and thirty percent respectively of the costs incurred by the latter. Thus, the type of surgery performed and the presence or type of secondary diagnosis make a considerable difference in the hospital product provided to the patient. For this reason, patient case types determined solely by primary diagnosis is not acceptable for use in defining hospital case mix since it is not precise enough to account for either the condition of the patient or the complexity of the treatment protocol.

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* The 9th Revision, International Classification of Diseases, Clinical Modification (ICD-9-CM) was implemented as of January 1, 1979.

Another patient classification scheme in wide use is that developed by the Professional Activity Study (PAS) of the Commission on Professional and Hospital Activities (CPHA), who publishes tables of length of stay statistics based on data from participating hospitals [7]. These tables present summaries on the basis of primary diagnosis, the presence of additional diagnoses, the presence of any surgeries, and age. Specifically, the PAS classification divides all possible primary diagnoses into 349 mutually exclusive major diagnostic categories. Each of these major diagnostic categories is then divided on the presence or absence of a secondary diagnosis, presence or absence of any surgery and five age categories (0-19, 20-34, 35-49, 50-64, 65+).* This results in 20 subcategories for each of the 349 major diagnostic categories for a total of nearly 7000 patient classes. The information is currently used extensively by Professional Standards Review Organizations (PSROs) in setting length of stay check points as part of their concurrent review process.

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* For major categories 342-349 pertaining exclusively to newborns birthweight is used in place of age.

Although the PAS scheme takes into account additional patient attributes such as secondary diagnosis, age and information related to the treatment process such as operation status, these may still be insufficient in certain instances to describe adequately a case in terms of output utilization. Refer to the example described above where the specific type of operation differentiated one set of surgical ulcer patients from another. Thus, because of its uniform structure throughout all 349 diagnosis groups, the PAS scheme tends to over specify in some diagnostic categories where the extra variables may not be particularly relevant as regards utilization of facilities and under specify in others where more precise information is required.

As an alternative patient classification scheme, the Diagnosis Related Groups (DRGs) have been constructed based on a procedure referred to as the significant attribute method. The fundamental purpose of the DRG approach is to identify in the hospital acute care setting a set of case types, each representing a class of patients with similar processes of care and a predictable package of services (or product) from an institution. Using this approach, the entire range of diagnostic codes was initially divided into broad disease areas, such as Diseases of the Eye, Diseases of the Ear, Cerebrovascular Diseases, and Infectious Diseases. Each of these categories was further subdivided into groups based on values for those variables that demonstrated an effect in predicting output as measured by length of hospital stay. It was decided to use length of stay (LOS) as opposed to some other output measure since it is an important indicator of utilization, as well as being easily available, well standardized, and reliable. The use of LOS and its relation to other measures is discussed further in the next section. The 383 Diagnosis Related Groups or DRGs which resulted from this process are interpretable from a medical perspective as well as similar with respect to their patterns of length of stay.

3.1.2 Construction of Diagnosis Related Groups (DRGs)

The primary objective in the construction of the DRGs was a definition of case types, each of which could be expected to receive similar outputs or services from a hospital. In order that the set of definitions be easily implemented in a wide range of settings as well as meaningful to medical and non-medical users, it was considered important that the resultant classification scheme have the following attributes:

1. It must be interpretable medically, with subclasses of patients from homogeneous diagnostic categories. That is, when the patient classes are described to physicians, they should be able to relate to these patients and be able to identify a particular patient management process for them.
2. Individual classes should be defined on variables that are commonly available on hospital abstracts and are relevant to output utilization, pertaining to either the condition of the patient or the treatment process.
3. There must be a manageable number of classes preferably in the hundreds instead of thousands that are mutually exclusive and exhaustive. That is, they cover the entire range of possible disease conditions in the acute care setting, without overlap.
4. The classes should contain patients with similar expected measures of output utilization.
5. Class definitions must be comparable across the different coding schemes.

With respect to point three, the number of classes considered manageable would clearly depend on the situation in which the patient classes were being applied. Any amount of aggregation involves a tradeoff between loss of specificity and ease of review of statistical summaries for comparison purposes. It was decided to construct a set of approximately 500 groups to be used as the basic framework of case types. These could then be further refined or aggregated as needed by investigators depending on the nature of the application.

A number of procedures were tested as potential ways of constructing the groups. Initially, a normative approach was used which involved having clinicians define case types using values of variables which they felt were important for determining the amount and type of services utilized. There was a tendency for their definitions to include an extensive set of specifications, requiring information which might not always be collected through a hospital's medical information system. If the entire range of patients were classified in this manner, it would ultimately lead to thousands of case types, most of which describing patients seen infrequently at an institution. It was therefore recognized that the process of case definition would be facilitated if data from acute care hospitals could be examined to determine the general characteristics and relative frequency of discharges. Also, statistical algorithms would be useful to suggest ways of forming patient classes that are homogeneous with respect to some aggregate output utilization measure.

This type of approach requiring the simultaneous inputs of physician judgement, efficient information processing, and statistical algorithms was adopted for the construction of the DRGs. An automated process was developed for screening a large amount of data with the aid of statistical algorithms. Physician review was required to insure that the classes formed by the process were medically meaningful. Length of stay (LOS) was used as the measure of output. While it may not be as accurate an indicator of the level of output as actual costs, it is still an important indicator of utilization as well as being easily available, well standardized, and reliable. The use of LOS as a measure of case complexity has been studied by other researchers. Luke in his work on case mix measurement [19] established the high degree of correlation between LOS and total charges rendered the patient. Lave and Leinhardt found significant correlation between LOS and measures of case mix complexity [16].

The process of forming the DRGS was begun by initially partitioning the database into mutually exclusive and exhaustive primary diagnostic areas, called Major Diagnostic Categories. Each major category was then examined separately and further subdivided into groups based on values of variables suggested by the statistical algorithm. Physician review of these recommended subdivisions often lead to modification. Thus, at each stage of the process the subgroups were based both on statistical criteria as well as physician judgement. The precise variables which were included in class definitions varied across the major categories. For example, age was determined to be important in explaining utilization for hernia patients, but not an important factor for gastric ulcer patients. From each Major Diagnostic Category a number of final patient classes was formed. These final patient classes are the Diagnosis Related Groups. A more extensive discussion of the database, the statistical algorithm, and the general strategy used in constructing the DRGs is presented in the following subsections.

Database

The database used to construct the scheme contained approximately 500,000 hospital records from 118 institutions in New Jersey, 150,000 records from one Connecticut hospital and 52,000 records of federally funded patients from 50 institutions in a PSRO region. These records contained demographic information about each patient (e.g., sex, age) as well as clinical and diagnostic information related to his hospital stay (e.g., problems/diagnoses, surgical procedures, special services used).

Diagnostic information in the database was coded with both classification systems, ICDA8 and HICDA2. Since there is not a direct match between the two schemes, data from all hospitals could not be combined in a unified database. Thus, it was decided to construct the classification scheme using the more prevalent ICDA8 codes as the standard. The ICDA8 version was then translated to HICDA2. This translation was evaluated with hospital data and necessary modifications were made to insure the consistency of the classification across the two coding schemes. Both ICDA8 and HICDA2 record surgical procedures using three digit codes. These procedure codes cover not only surgeries performed but also some therapies and minor diagnostic procedures as well. For ICDA8, the ranges of codes which were considered to reflect actual surgery are 010-999 and A10-A59. Likewise, for HICDA2 the actual surgical code range is considered to be 010-920 and 933-936. In constructing the patient classification scheme, only codes within these ranges were considered as surgical procedures.

Statistical Methodology

The particular statistical methodology employed is a variation of the Automated Interaction Detector (AID) method of Sonquist and Morgan, which has previously been applied in the analysis of complex sample survey data at the University of Michigan Survey Research Center [25]. The objective of this approach is to examine the interrelationships of the variables in the database and to determine, in particular, which ones are related to some specified measure of interest, referred to as the dependent variable. This is accomplished by recursively subdividing the observations, through binary splits, into subgroups based on values of variables that maximize variance reduction or minimize the predictive error of the dependent variable. Subgroups are designated terminal groups when they cannot be partitioned further either because the sample sizes are too small or the remaining variation is either too low to be reduced further or unexplainable in terms of the variables in the database. Each observation is contained in one and only one of these terminal groups, with a predicted value equal to the mean of the group. That is, if y_{kj} is the value of the dependent variable for the j'th observation within the k'th group then

$$y_{kj} = \bar{Y}_k + e_{kj} \tag{2.1}$$

where $\bar{Y}_k$ is the mean for all members in the k'th group and e_{kj} is the error in using $\bar{Y}_k$ to predict or estimate y_{kj}. This procedure minimizes the sum of the $\left(e_{kj}\right)^2$ over all observations. Thus, individual observations tend to have values close to the mean value of the terminal group to which they belong.

It was decided that the approach had to be implemented on an interactive basis to accommodate a high level of physician intervention. This was an important consideration since group formation using this algorithm is basically iterative in nature. Since no computer system existed that could handle large databases efficiently in the interactive mode, a new technology was developed called AUTOGRP [20]. AUTOGRP supports a facility that allows one to invoke an algorithm that determines partitions based on the variance reduction criterion of the AID algorithm. This command or capability of the system is referred to as the CLASSIFY facility.

Mathematically, the algorithm can be described as follows [20]. Each observation in a dataset has a value of the independent variable X and a value of the dependent variable Y. If there are N possible distinct values of the independent variable, then the subset of observations, or records which has each value X_i $(1 \leq i \leq N)$ is called a category. If there are M_i observations in the i'th category

$(1 \leq i \leq N)$, the total sum of squares (TSSQ) of the data with respect to the dependent variable is defined as

$$\mathrm{TSSQ} = \sum_{i=1}^{N} \sum_{j=1}^{M_i} (Y_{ij} - \bar{Y})^2 \qquad (2.2)$$

where Y_{ij} is the value of the dependent variable for the j'th observation in the i'th category of independent variable, and

$$\bar{Y} = \sum_{i=1}^{N} \sum_{j=1}^{M_i} Y_{ij} \Big/ \sum_{i=1}^{N} M_i \qquad (2.3)$$

or the mean value of the dependent variable in the entire dataset. The dataset can be partitioned on the basis of the independent variable into G groups, where each group is the union of specified categories. That is, we can define the mapping of categories to groups with sets R_k $(1 \leq k \leq G)$, such that

$$R_k \cap R_{k'} = \phi, \; k \neq k'$$

$$\bigcup_{k=1}^{G} R_k = \{1,2,3,\ldots, N\}$$

The "within group sum of squares" (WGSSQ) is the total of the squared deviations (differences)of each group's observations from the group mean with respect to the dependent variable and can be expressed as

$$\mathrm{WGSSQ}\ (k) = \sum_{i \in R_k} \sum_{j=1}^{M_i} (Y_{ij} - \bar{Y}_k)^2, \; 1 \leq k \leq G \qquad (2.4)$$

where

WGSSQ (k) = within group sum of squares for the k'th group

R_k = set of all categories of the independent variable in the k'th group

and

$$\bar{Y}_k = (\sum_{i \in R_k} \sum_{j=1}^{M_i} Y_{ij}) / (\sum_{i \in R_k} M_i) \qquad (2.5)$$

or the mean value of the dependent variable in the k'th group. The total within group sum of squares (TWGSSQ) for the G groups is the sum of the total squared deviations of each group's observations from the respective group mean and is given by:

$$\text{TWGSSQ (G)} = \sum_{k=1}^{G} \sum_{i \in R_k} \sum_{j=1}^{M_i} (Y_{ij} - \bar{Y}_k)^2 \qquad (2.6)$$

For a given independent variable, the CLASSIFY algorithm partitions observations into the particular set of groups that results in the minimization of TWGSSQ for a specific dependent variable. Since TWGSSQ is proportional to the variance left unexplained by the independent variable, minimization of TWGSSQ results in the minimization of the unexplained variance of the data.

DRG Formation from Major Diagnostic Categories

To facilitate the analysis over the wide range of disease conditions in the acute care setting, all diagnoses were initially divided into 83 mutually exclusive and exhaustive Major Diagnostic Categories. Their formation was also motivated to insure diagnostic homogeneity. Thus, the final clusters do not contain patients that transcended these categories. For example, from the point of view of output utilization, it may be appropriate to form a patient class with hemorrhoids, hypertrophy of tonsils, and normal delivery. The output utilization of these patients is very similar often requiring a relatively minor surgical procedure with a very short preoperative length of stay and a total hospitalization period of two or three days. However, the physicians who would treat these patients as well as the treatment processes of the problems they are presenting are quite different. Therefore, it was felt that including such patients in the same class would not define a medically meaningful category.

The specification of the Major Diagnostic Categories was performed by a committee of clinicians, following three general principles:

1. Major Diagnostic Categories must have consistency in terms of their anatomical, physio-pathological classification, or in the manner in which they are clinically managed.

2. Major Diagnostic Categories must have a sufficient number of patients.

3. Major Diagnostic Categories must cover the complete range of codes without overlap.

A list of these categories as defined by their ICDA8 and HICDA2 codes appears in Figure 1 . There is also an indication of the corresponding Professional Activity Study (PAS) diagnosis groups that correspond to each category. Note that the categories are very broad, such as Diseases of the Eye, Diseases of the Cardiovascular System and Infectious Diseases.

A consistent process was followed in partitioning each Major Diagnostic Category into Diagnosis Related Groups. First of all, each category was refined by eliminating certain unwanted observations. Dead patients were removed, bad records eliminated, and particularly deviant cases excluded from further analysis. Dead patients were removed from consideration since their lengths of stay were probably atypical of the disease or problem under consideration. Records with obvious coding errors or missing data were also eliminated because their information could be misleading. Observations with disproportionately high values of length of stay were excluded since a few deviant records could have a marked effect on the stability of a group's distribution.

The screened set of records in each category was then used as input to the second stage in which the CLASSIFY algorithm was applied to suggest groups of observations, on the basis of prespecified independent variables, that may be

Figure 1

Major Diagnostic Categories

Major Category	Initial Group Names	PAS Group No.	ICDA8 Codes	HICDA2 Codes
1	Infectious Diseases	1-8, 10-17	000-0689, 071-1360	001-0689, 071-1360
2	Malignant Neoplasm of Digestive System	18-23	140-1590	140-1590
3	Malignant Neoplasm of Respiratory System	24-25	160-1639	160-1639
4	Malignant Neoplasm of Skin	27	172-1739	172-1739
5	Malignant Neoplasm of Breast	28	174-1740	174-1742
6	Malignant Neoplasm of Female Genital Organ	29-33	180-1849, 2340, 6211 6291	180-1849
7	Malignant Neoplasm of Male Genital Organ	34, 35	185-1879	185-1879
8	Malignant Neoplasm of Urinary System	36, 37	188-1899	188-1899
9	Malignant Neoplasm of Other and Unspecified Sites	26, 38-42	170-1719, 190-1991	170-1719, 190-1990
10	Neoplasm of Lymphatic and Hemopoietic Tissue	43-46	200-2090	200-2090
11	Benign Neoplasm of Female Genital Organ	53-56	218-2219	218-2219
12	Benign Neoplasm of Other Sites	47-51, 58-62, 64-65	210-2169, 222-2330, 2341-2399, 2552, 7434, 7571	210-2169, 2220-2221 2228-2264, 2266-2399
13	Diseases of Thyroid and Other Endocrine Glands	63, 66, 70, 71	240-2460, 251-2551, 2559-2589	240-2460, 251-2589 2265
14	Diabetes	67-69	250-2509	250-2507
15	Nutritional and Other Metabolic Diseases	72-75	260-2790	260-2790
16	Diseases of Blood and Blood Forming Organs	76-80	280-2890, 2894-2899, 6345	280-2899
17	Psychoses Not Attributed to Physical Conditions	86-92	295-2990	306-3099
18	Neuroses	93-95	300-3029	310-3129
19	Alcoholic Mental Disorder and Addiction	84, 96, 97	291-2919, 303-3039	302-3029, 313-3139
20	Other Mental Disorders	81-83, 85, 98-103	290-2901, 292-2949, 304-3159	290-2959, 296-3019, 303-3059, 314-3189
21	Diseases of Central Nervous System	104-108	320-3499	320-3499
22	Diseases of Peripheral Nervous System	109-110	350-3580, 3589	350-3589
23	Diseases of Eye	111-121	360-3789	360-3789
24	Diseases of Ear and Mastoid Process	122-125	380-3879	380-3892
25	Hypertensive Heart Diseases	128, 129	400-4040	400-4050
26	Acute Myocardial Infarction	130	410-4109	410-4109
27	Ischemic Heart Diseases except AMI	131, 132	411-4149	411-4140
28	Arrythmia and Slowed Conduction	133	3581, 4272-4279	415-4169
29	Heart Failure	135	4270-4271, 7824	427-4279
30	Carditis, Valvular, and Other Diseases	126, 127, 134, 136	390-3980, 420-4260, 428-4299	390-3980, 420-4269, 429-4299
31	Cerebrovascular Diseases	137-141	430-4389	430-4389
32	Diseases of Vascular System	142-147, 150, 152-154	2891-2893, 440-4431, 4438-4480, 452-4549, 456-4589	440-4489, 452-4549, 456-4589
33	Pulmonary Embolism	148	450-4500	450-4500
34	Phlebitis and Thrombophlebitis	149	451-4519	451-4519
35	Hemorrhoids	151	455-4550	455-4559
36	Hypertrophy of Tonsil and Adenoid	163	500-5000	500-5000
37	Acute URI and Influenza	155, 156	460-4650, 470-4741	460-4650, 470-4700
38	Other Diseases of Upper Respiratory Tract	164-167	501-5089	501-5089
39	Pneumonia	157	480-4860	480-4860
40	Bronchitis	158, 159	466-4660, 490-4910	489-4919
41	Asthma	161	493-4930	493-4939
42	Other Lung and Pleural Diseases	160, 162, 168, 169	492-4920, 510-5199	492-4920, 494-4960 510-5199
43	Diseases of Oral Cavity, Salivary Glands and Jaws	170	520-5299	520-5299
44	Gastric and Peptic Ulcer	172-175	531-5349	531-5343
45	Upper GI Diseases except Gastric and Peptic Ulcer	171, 176, 177	530-5309, 535-5379	530-5309, 535-5379

Figure 1

Major Diagnostic Categories

Major Category	Initial Group Names	PAS Group No.	ICDA8 Codes	HICDA2 Codes
46	Appendicitis	178-180	540-5430	540-5430
47	Hernia of Abdominal Cavity	181-184	550-5539	550-5539
48	Entritis, Diverticula, and Functional Disorder of Intestine	185, 186	561-5649	561-5649
49	Diseases of Anus	187, 253	565-5660, 685-6850	565-5660, 685-6850
50	Miscellaneous Diseases of Intestine and Peritoneum	188	560-5609, 567-5699	560-5609, 567-5699
51	Diseases of Liver	9, 189, 190	070-0700, 0705-0709, 9992, 570-5739	070-0709, 570-5739
52	Diseases of Gall Bladder and Bile Duct	191, 192	574-5769	574-5769
53	Diseases of Pancreas	193	577-5779	577-5779
54	Diseases of Kidney and Ureter	194-197, 200	580-5910, 593-5935, 792-7920	580-5910, 593-5939
55	Urinary Calculus	198, 199, 201	592-5920, 594-5940	592-5921, 594-5949
56	Cystitis and Other Urinary Diseases	202-204	595-5999	595-5999
57	Diseases of Prostate	206, 57, 205	600-6020	2222, 600-6029
58	Diseases of Male Genital Organs	207-210	603-6050, 607-6079	603-6079
59	Diseases of Female Genital Organs	213-220	612-6210, 6212-6270, 6290, 6292, 6294, 6296-6299	612-6299
60	Diseases of Breast	52, 212, 211	217-2170, 610-6119	217-2179, 610-6119
61	Abortion	228-231	640-6459	640-6469
62	Obstetrical Diseases of Antepartum and Puerperium	221-227, 250	630-6344, 6346-6399 670-6730, 6739-6780	631-6399, 670-6789
63	Normal Delivery	232	650-6500	650-6500
64	Delivery with Complication	233-249	651-6620, 6731	651-6649
65	Diseases of Skin and Subcutaneous Tissue	251, 252, 254-255	680-6840, 686-7099	680-6840, 686-7099
66	Arthritis	256-258	710-7150	710-7150
67	Derangement and Displacement of Intervertebral Disc	265, 266	725-7259	725-7259
68	Diseases of Bone and Cartilage	261-264	7171-7180, 720-7249	7171-7180, 720-7249
69	Other Diseases of Musculo-Skeletal System	259, 260, 267 268-271	716-7170, 726-7389	716-7169, 719-7199, 726-7390
70	Congenital Anomalies	272-282	740-7433, 7438-7570, 7572-7599	740-7599
71	Normal Mature Born	342, 343	Y20-Y209, Y22-Y239, Y26-Y279	Y20-Y209, Y22-Y229 Y24-Y249
72	Certain Diseases and Conditions Peculiar to Newborn Infants	283, 344-349	Y21-Y219, Y24-Y259, Y28-Y299, Y005, 760-7799	Y21-Y219, Y23-Y239 Y25-Y299, Y40-Y489, 760-7689
73	Symptoms and Signs Referable to Nervous, Respiratory, and Circulatory Systems	284-287	4432, 780-7808, 7814-7815, 7817-7823, 7825-7834, 7836-7837	770-7709, 773-7769, 778-7799
74	Symptoms and Signs Referable to GI and Urinary System	288-290	784-7865	780-7839
75	Miscellaneous Signs, Symptoms, and Ill-defined Conditions	291-295	606-6060, 628-6280, 6293, 6295, 7810-7813, 7816, 7835, 7866-7889, 790-7910, 793-7969	771-7728, 777-7779, 784-7969
76	Fractures	296-310	800-8299	800-8299
77	Dislocation and Other Musculo-Skeletal Injury	311-316	830-8480	830-8489
78	Internal Injury of Cranium, Chest, and Other Organs	317-320, 326, 332	850-8699, 950-9599, 9953, 9954	850-8699, 900-9049, 950-9599
79	Open Wound and Superficial Injury	321-325, 327-330	870-9390 996-9969	870-8979, 910-9391
80	Burn	331	940-9499	940-9498
81	Complication of Surgical and Medical Care	338, 339	997-9991, 9993-9999	996-9999
82	Adverse Effects of a Certain Substance	333-337	960-9952, 9955-9959	960-9959
83	Special Admissions and Examinations Without Reported Diagnosis	340, 341	Y00-Y004, Y006-Y159, 379-3793, 388-3899, 789-7899	Y00-Y199, Y50-Y869

different with regard to length of stay. The set of independent variables selected as input to the algorithm was intentionally limited to those variables descriptive of the patient, his disease condition and his treatment process that would be readily accessible on most discharge abstracts, specifically diagnoses, surgical procedures, age, sex and clinical service. This constraint was applied for several reasons. First, mean lengths of stay are observed to vary across levels of these variables in descriptive statistical summaries of hospital discharge data [23]. Second, these variables are always recorded and entered in almost all hospital information systems. This increases the classification's potential for implementation in most research and applied health care settings. Including other items of information such as ancillary services used would limit its applicability to those systems that collect such data, which would exclude, for example, the PSRO PHDDS database. Finally, restricting the variables to this set also simplifies the class definitions and controls to some extent the final number of categories. A classification with numerous groups and a complex definitional structure is unmanageable.

For each independent variable, output from the CLASSIFY procedure included the total number of observations in the dataset, the total number of different values the variable assumed (i.e. number of categories or cells), the number of groups formed, the total sum of squares (TSSQ) and the percent reduction in total sum of squares attained by such a grouping ((TSSQ-TWGSSQ)/TSSQ)*100. Once these results were obtained, a clinician selected the most appropriate variable for a division.

The interpretation of the partitioning suggested by the algorithm was a complex task, with many factors examined and weighed simultaneously. The decision to accept, to reject or possibly to revise the recommended partitioning was based on both the statistical evidence and the clinician's medical knowledge. The statistical results were examined in light of certain criteria. Variables yielding the highest percentage reduction in variance were prime candidates for dividing the dataset. However, the number of cells or values for those variables and the number of groups formed were also considered. It is an artifact of the algorithm that many partitions can be created when the independent variable has a wide range of values. Moreover, too many groups formed at the first split become difficult to manage and are of questionable significance. For example, secondary diagnosis often had many different values and thus often produced significant variance reduction by forming many subgroups. However, such groups were difficult to interpret as a primary partition and tended to be of limited value. In all cases, groups were further examined in a more descriptive framework to determine if the statistical significance was supported by medical interpretability.

The fact that a variable which appeared to be powerful in explaining variance was not selected at a particular stage does not mean that the variable is being ignored. Two possibilities still exist. If that variable is independent of other variables in explaining variance it will appear in subsequent stages with the same power as at the earlier stage. If, however, it is correlated with a variable chosen at an earlier stage, then its explanatory power at subsequent stages will be lessened according to the strength of the correlation. For example, if secondary diagnosis was strongly related to age and age was selected as a partitioning variable then secondary diagnosis would not appear powerful in subsequent clustering.

Groups were then generated based on the most appropriate variable, that is, the one which met as many of the criteria specified above as possible. In particular, it 1) exhibited a significant reduction in variance relative to most of the other variables, 2) created a manageable number of groups based on a relatively small number of values of the independent variable, and 3) created groups whose means were significantly different. Also, groups formed were homogeneous from a clinical perspective.

Once each Major Diagnostic Category was initially partitioned into subgroups based on the values of an independent variable, a decision was made whether or not to further subdivide each subgroup based on any of the other available variables or to end the partitioning process by treating them as terminal groups. The statistical basis for this decision was determined by a set of stopping rules. For any given group, the partitioning ceased when either one of the following conditions was met:

1. The group was not large enough to warrant another classification, that is when the number of observations in the group was less than 100.
2. None of the variables reduced unexplained variation by at least 1%, or $((TSSQ-TWSSQ)/TSSQ)*100<1\%$.*

Otherwise, the group was further subdivided according to the criteria discussed previously for generating new subgroups. In some cases, however, the process was terminated for non statistical reasons regarding overall manageability (e.g., maintaining a low number of total groups) or medical interpretability.

This grouping process resulted in the formation of 383 final groups or DRGs each defined by some set of the following patient attributes: primary diagnosis, secondary diagnosis, primary surgical procedure, secondary surgical procedure, age, and, in one case clinical service area. While other variables such as sex, tertiary diagnosis or surgical procedure were examined, they were not found to be significant in explaining output utilization. A list of these groups with a brief narrative description of their contents appear in Appendix A. A more complete specification can be obtained from the Health Care Financing Administration [1].

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*This 1% bound was increased in certain Major Diagnostic Categories.

The DRGs vary considerably in their structure across the Major Diagnostic Categories. Some Major Diagnostic Categories are not further subdivided, such as Category 35, Hemorroids in which no variable demonstrated a sufficient effect in further explaining output utilization. On the other hand, Appendicitis, Category 46, is further subdivided on the basis of specific primary diagnosis and the presence of a secondary diagnosis. This results in four DRGs: appendicitis (without peritonitis) and without a secondary diagnosis, appendicitis (without peritonitis) with a secondary diagnosis, appendicitis (with peritonitis) without a secondary diagnosis, and appendicitis (with peritonitis) with a secondary diagnosis. This symmetric breakdown suggests that the effects of primary diagnosis and the presence of a secondary diagnosis are additive in nature. Major Diagnostic Category 76, Fractures, has the most complex structure resulting in 13 DRGs, indicating both the importance and interaction of four variables: primary diagnosis, secondary diagnosis, primary surgical procedure, and age.

It should also be noted that when variables are highly correlated, very often only one appears in the classification for a specific major category. An extreme example of this is Major Diagnostic Category 36, Hypertrophy of Tonsils and Adenoid, where almost everyone has a tonsillectomy and/or an adenoidectomy. The high correlation of primary surgical procedure with primary diagnosis results in no further variance reduction in the category that can be attributed to surgical procedures. Thus, although surgery is almost always used in the treatment of patients with Hypertrophy of Tonsils and Adenoids, since virtually every patient in this category had the same surgical procedure, the surgical information did not differentiate the utilization of these patients and was therefore not used in the formation of the DRGs for this category.

An Example

The iterative partitioning process used in forming the DRGs can best be illustrated in the context of an example - the classification of Major Diagnostic Category 55: Urinary Calculus. This category contains patients with a primary diagnosis (ICDA8 codes) of either:

592	Calculus of kidney and ureter
594	Calculus of other parts of the urinary system

The formation of the DRGs from this Major Diagnostic Category is summarized in the tree diagram presented in Figure 2. First, this category is partitioned into three groups based on the variable primary surgical procedure. The first group contains nonsurgical patients, which are those with either no operation or with a procedure code (ICDA8) outside the range 010-999, A10-A59.* The second and third groups are formed on the basis of the specific procedure performed. In particular, the more complicated procedures performed on patients with a urinary calculus - nephrotomy, ureterotomy, cystotomy - are in the third group, while relatively minor procedures associated with this diagnosis - cystoscopy, passage of catheter to kidney - are contained in the second. The nonsurgical group is partitioned further into two groups based on the presence or absence of a secondary diagnosis. In summary, the classification process resulted in the formation of four terminal groups or DRGs 239-242 from the Major Diagnostic Category Urinary Calculus:

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*Operations coded outside these ranges are not considered actual surgical procedures since they represent minor procedures or therapies.

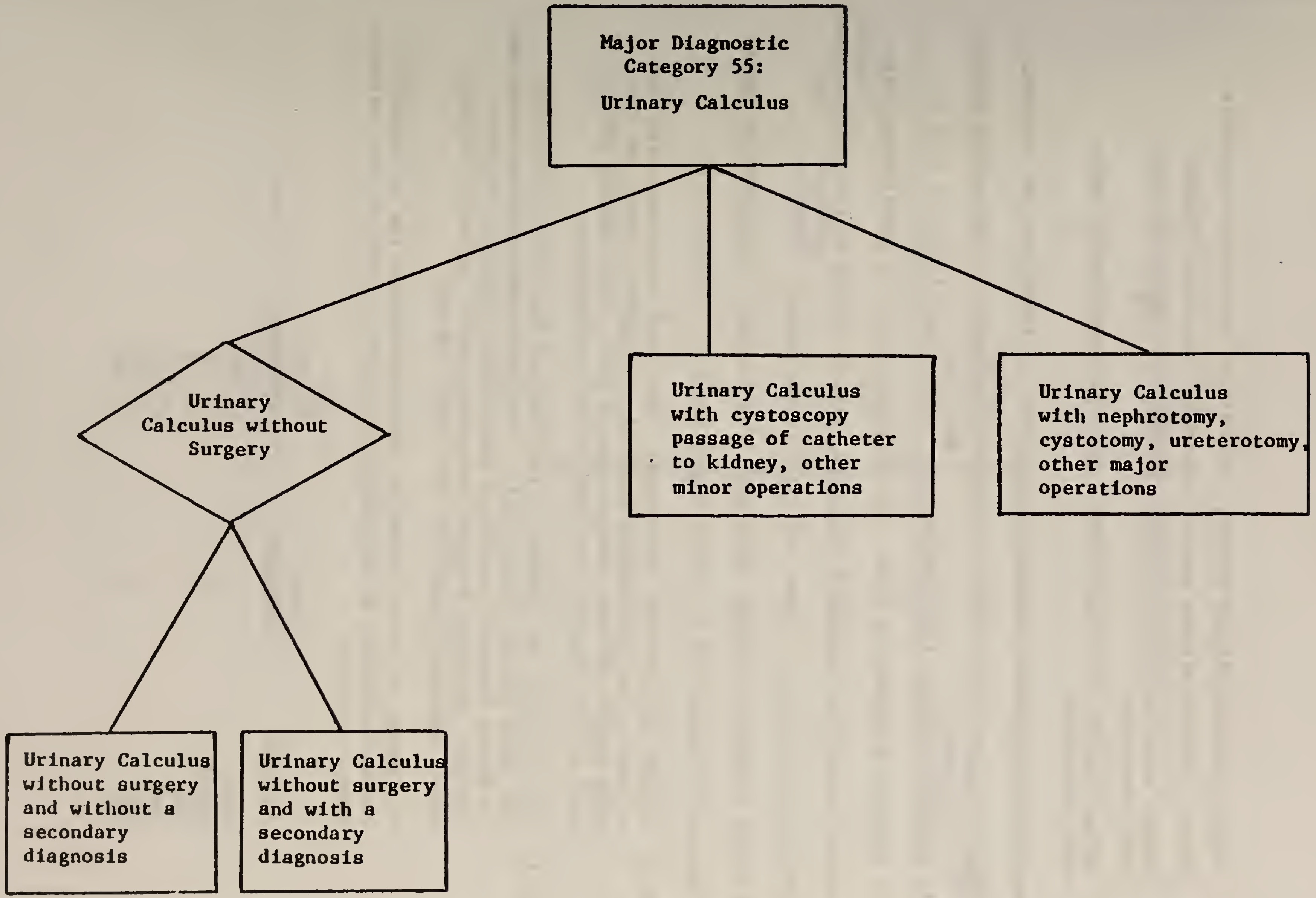
Major Diagnostic
Category 55:
Urinary Calculus
Urinary Calculus without Surgery
Urinary Calculus with cystoscopy passage of catheter to kidney, other minor operations
Urinary Calculus with nephrotomy, cystotomy, ureterotomy, other major operations
Urinary Calculus without surgery and without a secondary diagnosis
Urinary Calculus without surgery and with a secondary diagnosis

Figure 2
Tree Diagram Illustrating Partitioning of Urinary Calculus Patients

239 Urinary calculus without surgery, and without a secondary diagnosis

240 Urinary calculus without surgery and with a secondary diagnosis

241 Urinary calculus with cystoscopy, passage of catheter to kidney, other operations

242 Urinary calculus with nephrotomy, cystotomy, ureterotomy, other major operations

A descriptive statistical summary of data coded in ICDA8 from the original database used to construct the DRGs, is presented in Figure 3. The entire Major Diagnostic Category contains 1425 observations, with a mean length of stay of 6.93 and a standard deviation of 6.44. The variables used in partitioning this group, primary surgery and secondary diagnosis, explain 42.93% of the total variance with 41.75% attributed to the former and 1.17% to the latter.

The actual process of forming these DRGs from the Major Diagnostic Category Urinary Calculus is summarized in the following steps:

STEP 1: Fifteen records were eliminated: three with a discharge status of death, ten with invalid surgical or diagnosis codes, and two with lengths of stay greater than 60 days. This reduced the size of the category from 1440 to 1425 observations.

STEP 2: The algorithm was invoked on this refined data set to determine the basis for an initial split. The independent variables selected to define potential subgroups were primary surgical procedure (oper1), secondary surgical procedure (oper2), primary diagnosis (dx1), secondary diagnosis (dx2), age, and sex.

The number of groups formed by the algorithm and the corresponding percent reduction in unexplained variation for each of the variables were as follows:

Variable	Number of Groups	Percent Reduction
oper1	3	41.89%
oper2	4	21.37%
dx1	1	0.0 %
dx2	5	30.11%
age	3	8.19%
sex	2	1.63%

Major Diagnostic Category 55: Urinary Calculus

Size= 1425   Mean= 6.93   Standard Deviation = 6.44

Independent Variables		Partial Variance Explained	Drg #	Size	Mean Length of Stay	Standard Deviation
Primary Surgery:		41.75				
None	Secondary Diagnosis	1.17				
	None		239	449	3.28	2.88
	One or More		240	262	5.32	5.01
Minor			241	428	6.36	4.30
Major			242	286	14.99	7.39

Total Variation Explained = 42.93

Figure 3

Descriptive Statistics for the Partitioning of Urinary Calculus

Since the greatest reduction in unexplained variation was achieved with oper1, and a limited number of groups (3) this variable was considered the prime candidate for initial subdivision of the category. The algorithm suggested three groups whose contents are described in Figure 4. This figure presents the different surgical procedures contained in each group (INDEP VAR), the corresponding number of observations (SIZE), and the mean length of stay (MEAN). Note that over 98% of the observations in the first group have no surgical procedure listed. The second group primarily contains observations with relatively minor procedures such as cystoscopy and urethroscopy (A46) and passage of catheter to kidney (557), while the third group includes somewhat more complex procedures as ureterotomy (550), cystotomy (560), and pyelotomy (541).

On the basis of these results, it was decided to divide the initial group of Urinary Calculus patients into three groups, similar to those suggested by the algorithm. Namely a group of nonsurgical patients, a group with relatively major procedures as those listed under group 3 in Figure 4, and finally a group of all other procedures which includes cases with minor procedures such as those listed under groups 1 and 2 , and biopsy of urinary tract (A21) in group 3. While this latter group represents all other surgeries not explicitly listed under group 3, it is primarily represented by the two procedures cystoscopy and urethroscopy (A46) and passage of catheter to kidney (557).

STEP 3: Each of the groups formed in Step 2 was then considered for further subdivision. First of all, with respect to the nonsurgical patients, the number of groups formed by the algorithm and the corresponding percent reduction in unexplained variation for each of the variables (except oper1 and oper2) were as follows:

Variable	Number of Groups	Percent Reduction
dx1	1	0.0%
dx2	4	22.66%
age	4	14.18%
sex	1	0.0 %

A closer examination was made of the characteristics of the four groups formed using the variable secondary diagnosis (dx2), since it exhibited the greatest percent reduction in unexplained variation. The descriptive statistics for each of the groups are summarized below:

Group 1

SIZE	MEAN	INDEP VAR	
1	2.00	749	Other antepartum procedures to terminate pregnancy
1	2.00	571	Meatotomy
1	2.00	277	Venous anastomosis, intra-abdominal
1	2.00	249	Other operations on peripheral vessels
1	3.00	430	Incision of bile (hepatio) ducts
1	3.00	862	Arthrocentesis
1	3.00	601	Vasectomy
1	3.00	921	Local excision of lesion of skin and subcutaneous tissue
23	3.28	000	No code
688	4.08		No code
1	5.00	551	Ureterectomy

Group 2

SIZE	MEAN	INDEP VAR	
2	5.50	574	Repair and plastic operations on urethra
7	5.71	559	Other operations on ureter
218	6.25	A46	Cystoscopy and urethroscopy without effect upon tissue
5	6.40	A45	Endoscopy of colon and rectum without effect upon tissue
15	6.40	568	Removal of calculus and drainage of bladder without inc
2	6.50	572	Excision or destruction of lesion of urethra
146	6.59	557	Passage of catheter to kidney
21	7.14	575	Dilation of urethra
1	9.00	A16	Biopsy of thorax

Group 3

SIZE	MEAN	INDEP VAR	
2	10.00	A21	Biopsy (continued) of urinary tract
2	11.50	566	Repair and other plastic operations on bladder
1	12.00	A44	Esophagoscopy and gastroscopy without effect upon tissue
1	13.00	549	Other operations on kidney
1	13.00	556	Repair and plastic operations on ureter
3	13.67	561	Local excision and destruction lesion of bladder trans
2	14.00	562	Local excision and destruction of lesion of bladder ot
3	14.00	582	Prostatectomy, transurethral
1	14.00	583	Prostatectomy, other
8	14.13	545	Nephrectomy, complete
72	14.46	541	Pyelotomy
40	14.47	560	Cystotomy
101	14.63	550	Ureterotomy
19	15.89	540	Nephrotomy
1	16.00	513	Hemorrhoidectomy
11	16.82	544	Nephrectomy, partial
1	17.00	546	Repair and plastic operations on kidney
		570	Urethrotomy, external
1	21.00	A27	Biopsy of bone
1	21.00	563	Cystectomy, complete or partial
1	22.00	685	Ligation and division of fallopian tubes bilateral
3	22.33	558	Ureterolysis
1	29.00	543	Local excision and destruction of lesion of kidney

Figure 4

Suggested Partitioning (three groups) of
Urinary Calculus Patients on the Basis of
Type of Primary Surgery

Group	Number Obs	Mean	Standard Deviation
1	534	3.22	2.71
2	109	4.87	2.70
3	50	7.68	4.93
4	18	12.83	12.37

Several things were considered in evaluating the potential partitioning on secondary diagnosis. With respect to the distribution of observations, groups 3 and 4 were definitely too small (i.e. less than 100 observations) to be considered terminal groups and group 2 with 109 observations was marginal. Further, it was noted that over 80% of the observations in Group 1 had no secondary diagnoses listed and that the remaining cases in all four groups were distributed across 105 different secondary diagnosis codes, usually with less than 10 cases represented for each disease and with no apparent clinical pattern. Thus, it was decided that groups formed on the basis of specific secondary diagnosis were not particularly meaningful, but that a more manageable and interpretable partition from a medical perspective would be two groups based on the presence or absence of a secondary diagnosis. The descriptive statistics of these groups were as follows:

Group	Number Obs	Mean	Standard Deviation
No Secondary	449	3.28	2.88
Secondary	262	5.32	5.01

This alternative partition results in a markedly lower percent reduction in unexplained variation - 6.3%. But, in terms of the overall objectives of the classification process, the increase in interpretability and manageability was considered more important than the sacrifice in predictive error.

STEP 4: With respect to the other two groups formed in Step 2 on the basis of specific surgical procedure, the algorithm was applied using the variables secondary surgical procedure, primary diagnosis, secondary diagnosis, age, and sex. For the group with minor surgeries, the number of subgroups formed by the algorithm and the corresponding percent reduction in unexplained variation for the variables were as follows:

Variable	Number of Groups	Percent Reduction
oper2	2	13.36%
dx1	1	0.0 %
dx2	4	34.62%
age	2	4.73%
sex	1	0.0 %

Likewise the partitions with respect to these variables suggested for the group of relatively major procedures have the following characteristics:

Variable	Number of Groups	Percent Reduction
oper2	3	18.36%
dx1	2	1.26%
dx2	4	43.03%
age	2	3.85%
sex	1	0.00%

In both cases it appeared that secondary diagnosis had the strongest effect and was selected as the potential variable to use in forming subgroups. However, after examining the contents of the suggested groups, it was found in both instances that at least half the observations had no secondary diagnosis listed and the others had secondary diagnoses distributed across at least 100 different codes, with no apparent clinical consistency. That is, the diagnoses were dissimilar and few were represented by more than 10 cases. Thus, like the nonsurgical cases discussed in Step 3, it did not appear that further subsetting these groups on specific secondary diagnosis was meaningful from a clinical perspective.

Partitioning each group on the basis of the presence or absence of secondary diagnosis was considered. This would achieve a 2.1% reduction in unexplained variation for the minor surgical group and a 5.6% reduction for the major surgical group. In both instances, it was decided that there was not sufficient medical justification for a further breakdown of the surgical groups on the basis of secondary diagnosis. Moreover, in light of one of the major objectives of keeping the total number of classes low, additional groups formed at this stage of the partitioning of Urinary Calculus patients would be of questionable value. Therefore, the two surgical groups were not subsetted further but considered terminal groups.

STEP 5: The two subgroups formed from the nonsurgical cases on the basis of presence or absence of other diagnoses were evaluated to determine if they should be partitioned further or left intact as terminal groups. The algorithm was applied and produced the following results for the nonsurgical cases without multiple diagnoses.

Variable	Number of Groups	Percent Reduction
age	2	2.73%
oper2	2	2.06%
dx1	1	0.0 %
sex	1	0.0 %

and the results listed below for the nonsurgical cases with multiple diagnoses:

Variable	Number of Groups	Percent Reduction
age	3	13.05%
oper2	1	0.0 %
dxl	1	0.0 %
sex	1	0.0 %

With respect to the nonsurgical cases without multiple diagnoses, both sets of groups formed on the basis of age and secondary surgical procedure, respectively, were determined unacceptable. In each instance, over 95% of the observations fell into the first group, leaving the second group with fewer than 25 cases.

For the nonsurgical cases with multiple diagnoses, the three groups formed using age levels were considered as potential subgroups. The age levels defining the boundaries of the groups were 66 and 70. This partition was rejected for reasons similar to those above, namely the lopsided distribution of cases in the groups. Almost 90% of the observations had an age under 66.

Thus, the nonsurgical groups with and without multiple diagnoses were considered terminal groups.

We conclude, then, that specific surgical procedures and the presence of multiple diagnoses were important variables in predicting length of stay for Urinary Calculus patients. The four DRGs formed were significantly different ($\alpha = .01$) with respect to their average lengths of stay and are clinically interpretable. To be sure, by overruling some of the partitions suggested by the algorithm, a certain amount of explanatory power was sacrificed. But, the tradeoff was generating a reasonable number of subgroups or DRGs which could be interpreted from a medical perspective. Figure 5 presents a descriptive summary of the length of stay distributions for the groups formed as part of the partitioning process in this example.

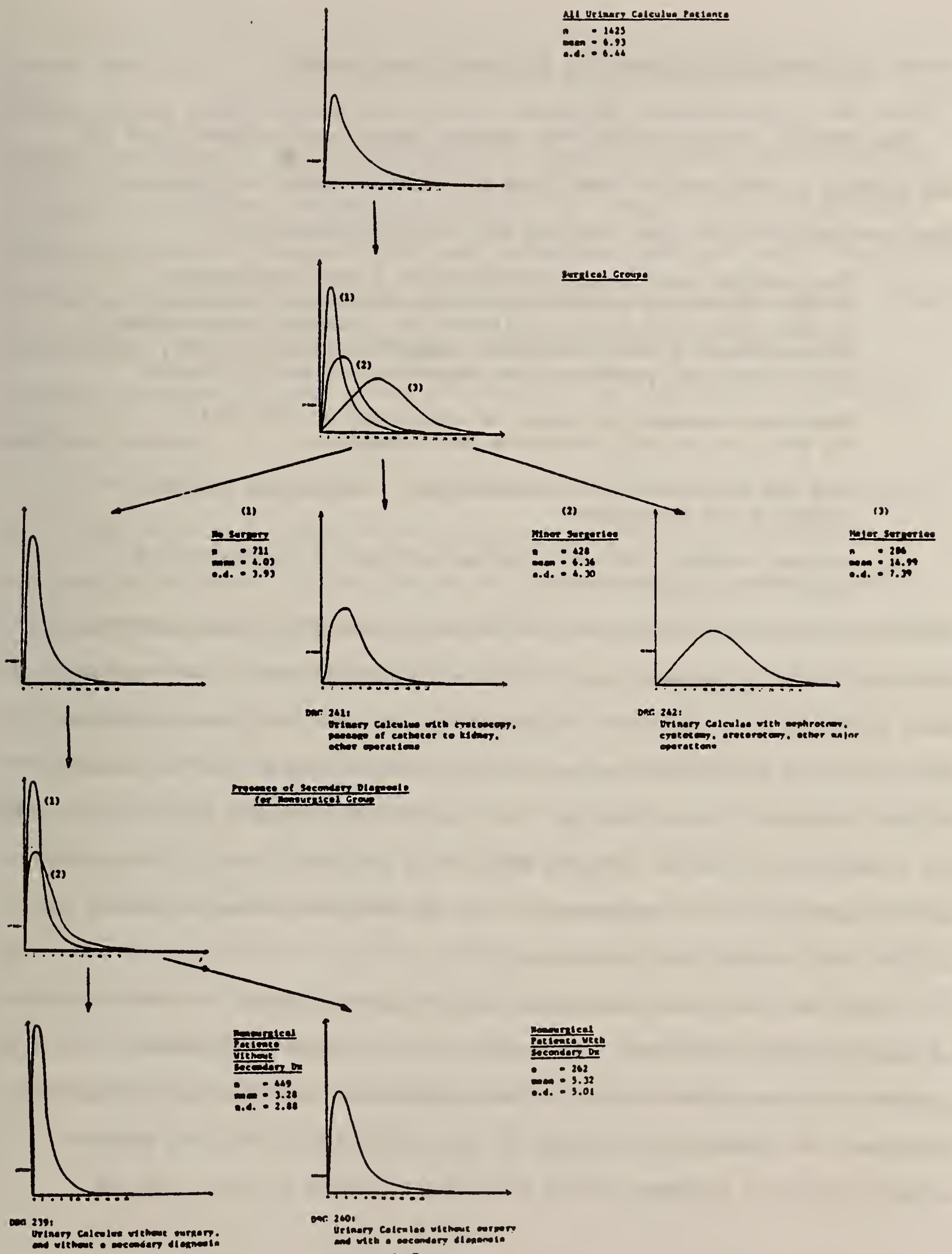

FIGURE 5
Summary of Length of Stay
Distributions for Groups Formed in Partitioning Process

3.1.3 Interpretation of the DRGs in Health Care Studies

The DRGs as constructed met the original research objectives, that is, they provide a definition of case types by relative output utilization, where the definition of case type has the following properties:

1. The variables used in the definition of a case are limited to those referring to the patient's condition and treatment process that are commonly collected in a hospital information system, namely primary diagnosis, secondary diagnosis, age, primary surgical procedure, and secondary surgical procedure.
2. There are a manageable number of case types or DRGs (383) and they are mutually exclusive and exhaustive.
3. Each DRG has clinical interpretability with closely related diagnoses and operations.
4. Patients within a DRG have similar patterns of utilization as measured by length of stay.

Achieving these objectives meant in all cases a tradeoff between maximizing explained variation and maintaining clinical interpretability. For example, there were some Major Diagnostic Categories which could have been partitioned into additional groups based on one of the variables used or the introduction of other variables. While this may have resulted in increased explained variation, the amount of increase was balanced against the potential loss in (1) medical interpretability, (2) the manageability of the resultant number of groups, and (3) the simplicity of case definition.

Since the statistical algorithms were primarily used as a screening device to suggest groups of patients with similar output utilization patterns, the process is to some extent subjective and dependent on the clinician making the decisions, the independent variables he was constrained to use, the dependent variable chosen to represent output utilization (length of stay), and the database examined. Thus, individuals analyzing their own data within this framework may decide other definitions are more meaningful and significant for their purpose. For example, if cost information is readily available and well standardized, that would be a preferable alternative to length of stay as the output utilization measure. Likewise additional independent variables may be incorporated, but the analyst should be aware of potential difficulties in this regard. Greatly expanding the set of variables that may be incorporated in a scheme tends to increase the number of final groups and restricts its application to within the immediate setting.

As they are now defined, the DRGs form a manageable, medically interpretable set of case types that allows one to control for differences in complexity attributable to patient characteristics as described by age, primary diagnosis, secondary diagnosis, primary surgical procedure and secondary surgical procedure. On the basis of values for these variables practitioners can gain some understanding of the patient being identified and specify within reasonable limits expected services to be delivered, criteria to be applied in treatment, and expected outcomes. This is not to say that providers of such care will always agree on the treatment process or that all will agree with the identification. There are certainly disease entities that are not as well understood as others and treatment protocols for which there is lesser or greater consensus among practitioners. For example, senile cataracts are almost always treated by a surgical lens extraction but there is still observed great variation in the case regime and length of hospital stay for this procedure. Thus, while senile cataract patients with lens extraction form a patient class, differences among providers still remain with respect to length of stay and other output measures which cannot be accounted for by patient characteristics or surgical procedures.

The development of the patient classes is not intended to inhibit in any way the practice of medicine but to offer one the capability of examining reasons for variations in service utilization, treatment process, and outcome. In this context, the groups can provide a framework for the initiation of an ongoing process of comparative analysis of health care with the long run goal of determining both the cost and value of any kind of care which might be delivered. With such information, meaningful dialogue among clinicians, administrators, planners, and regulators can proceed in rationalization of observed differences. Only in this way, can strategy, policy, and politics interact to the benefit of the communities served by each institution.

The classification of patient records into Diagnosis Related Groups is a constantly evolving process. In fact, the group structure described here represents the third classification scheme developed using the methodology presented in the previous section. As coding schemes change and data more current and representative of acute care institutions in the United States are collected these groups will be re-examined and revised accordingly.

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3.2 APPLICATIONS OF THE DRGS IN UTILIZATION REVIEW

Case Mix Analysis Reports

One of the original motivations for the development of the DRGs was to provide a framework of case types that reflects the relative complexity of patients seen at an institution. Since the aggregate utilization pattern of a hospital depends not only on its treatment processes but on the types of patients it treats, it is useful to have such a mechanism for two reasons:

1. to understand an individual hospital's behavior

   and

2. to make valid comparisons on such measures as cost and length of stay across institutions.

Variations in these measures has been the primary concern of a number of programs established within the last decade to examine hospital budgeting, cost containment, utilization review, and prospective reimbursement.

In particular, Professional Standards Review Organizations or PSROs were mandated under an amendment to the Social Security Act of 1972 to assure the quality and appropriateness of health care services delivered to federal beneficiaries. Specifically, PSRO's are responsible for the conduct of three interrelated functions:

Concurrent Review

Medical Care Evaluation Studies

Profile Analysis

While concurrent review is mainly concerned with establishing appropriate utilization practices, MCE Studies are conducted as in depth investigations into the quality of health care services. The third function, Profile Analysis, utilizes the data collected as part of the concurrent review process and is directed toward identifying areas of significant variation across both institutions and physicians. In this respect it is often used as a way of identifying topics for MCE's.

The primary objective of our research with the PSROs over the past two years has been the development of information systems to support effective data analysis strategies. That is, strategies which facilitate the identification, explanation, and followup of aberrant patterns. With respect to length of stay alone, large differences have been noted among hospitals from the same region. The extent to which this is due to their respective case mix needs to be determined in order to allow the PSROs to explain these differences and implement appropriate corrective procedures.

The purpose of this section is to present an overview with examples of an analysis strategy developed for the PSROs to identify and explain aberrant patterns among institutions in light of case mix as defined by DRGs. A series of reports were designed and programmed under this contract to support this analysis activity. The strategy has 3 steps and will be illustrated in the context of sample reports generated from utilization data from a set of institutions in a PSRO region.

1. In the first stage the average length of stay for each institution under consideration is computed and compared to that for the entire region. The difference is partitioned into three components:
    a. the amount of difference attributed to hospital treatment patterns,
    b. the amount of difference attributed to its case mix,
    c. the amount of difference attributed to the interaction of hospital treatment patterns and case mix.

The purpose of this first stage is therefore to get some general understanding of the impact of institutional case mix on length of stay patterns.

2. In the second stage, individual hospitals are examined and their performance within each DRG is compared to the other institutions. Statistical algorithms are used to flag the institutions with significantly higher or lower mean lengths of stay than those for the region. Thus, the objective at this stage is to screen the data base and identify for each institution those areas as defined by DRGs where there may be potential utilization problems.
3. In the final stage, deviant patterns among a set of institutions within a DRG are examined in light of potential explanatory variables.

STAGE I:

With respect to Stage I, Figure 6 contains a sample report presenting case mix related statistics for a set of hospitals in a given region. Of particular interest here is a comparison of their inpatient utilization as measured by length of stay in days. First of all, as noted at the top of the report, all patients in the region, regardless of institution or case type, experienced an average stay of 6.772 days. The report's objective is to examine each hospital's utilization in light of both case mix and length of stay patterns and to compare it to the others using the region as the standard reference. The precise mathematical formulation of the statistics contained in the report is presented elsewhere,[3] but a brief descriptive summary is presented here in order to demonstrate the application of DRGs in the case mix analyses.

CASE MIX REPORT

REGIONS AVERAGE LOS = 6.772

(1)	(2) OBS	(3) AVERAGE LOS	(4) CASE MIX ADJUSTED LOS	(5) LOS WEIGHTED CASE MIX	(6) AVERAGE LOS INDEX	(7) LOS INDEX	(8) CASE MIX INDEX	(9) AVERAGE LOS DIFFER	(10) DIFFER DUE TO LOS	(11) DIFFER DUE TO CASE MIX	(12) INTERACT DIFFER
HOSPITAL 1	12666	7.580	6.850	7.433	1.119	1.012	1.098	.808	.079	.661	.068
HOSPITAL 2	24049	6.533	6.591	6.643	.965	.973	.981	-.239	-.180	-.128	.070
HOSPITAL 3	14117	6.798	6.256	6.999	1.004	.924	1.034	.026	-.516	.227	.315
HOSPITAL 4	41643	7.479	7.320	6.960	1.105	1.081	1.028	.708	.548	.188	-.029
HOSPITAL 5	5499	6.395	6.068	7.072	.944	.896	1.044	-.377	-.704	.300	.027
HOSPITAL 6	8167	6.256	6.585	6.398	.924	.972	.945	-.516	-.187	-.374	.045
HOSPITAL 7	2828	6.493	6.434	7.230	.959	.950	1.068	-.279	-.338	.458	-.399
HOSPITAL 8	20494	4.943	5.457	5.785	.730	.806	.854	-1.828	-1.315	-.986	.473

Figure 6

Sample Case Mix Report for Eight Institutions

Representing a Given Region

A hospital identifier appears in the first column followed by the corresponding number of observations (OBS) or records from that institution used in the computation of the statistics in the remaining columns. Column 3 contains the overall average length of stay (AVERAGE LOS) for patients in that institution, which is the number of bed days consumed per discharge. A case mix adjusted length of stay (CASE MIX ADJUSTED LOS) appears in column 4 and is the mean length of stay the hospital could have experienced with the region's case mix. For the i'th hospital, it is computed as the sum of the products $a_{ij} \times P_j$ across all DRGs, where a_{ij} is the average stay in the j'th DRG in hospital i, and P_j is the proportion of the region's cases in DRG j. As such, it standardizes or holds constant case mix across all institutions and results in a measure that one can use to compare hospital utilization based on length of stay.

As a complement to the case mix adjusted length of stay, column 5 contains the average length of stay the hospital would have experienced with its own case mix, but the region's average length of stay within each of the DRGs (LOS WEIGHTED CASE MIX). That is, for the i'th hospital it is computed as the sum of the products $A_j \times p_{ij}$ across all DRGs, where A_j is the region's average stay in the j'th DRG, and p_{ij} is the proportion of the i'th hospital's cases in the j'th DRG. Since it uses a standard set of relative weights (A_j) for the DRGs, it can be interpreted as a relative measure of case mix complexity, with higher values indicating a more complex case mix, that is, a large proportion of cases with high expected resource consumption. In interpreting this measure, it should be noted that since some DRGs include a process measure in their definition, namely surgery, complexity is a function of both the condition of patients as well as the treatment process selected by physicians. Columns 6 through 8 are indices computed by dividing the measures in columns 3 through 5, respectively, by the region's average length of stay.

Columns 9 through 12 present the observed difference between the institution's and region's average length of stay (AVERAGE LOS DIFFER) and indicate to what extent this difference can be attributed to DRG specific average length of stay or the a_{ij} (DIFFER DUE TO LOS), the case mix of its patients or the p_{ij} (DIFFER DUE TO CASE MIX), and the combination of the two or their interaction (INTERACT DIFFER). The first three differences are computed by subtracting the region's average length of stay from the measures in columns 3 through 5. The interaction component is the residual or the amount of the differences between the hospital and the region not accounted for by the LOS difference (column 10) or the case mix difference (column 11). For the i'th hospital it is equal to the sum of the cross products $(a_{ij} - A_j) \times (p_{ij} - P_j)$ across all DRGs.

The utilization of the report lies in interpreting the differences observed between an individual institution and the set of institutions or region as a whole. For example, consider hospital 4, the largest with 41,643 cases (column 2). Its average length of stay was one of the longest, 7.479 days (column 2) or .708 days longer than the region (column 9). This difference can be attributed in varying degrees to the following components:

1. differences in case composition or case mix,
2. differences in case specific average lengths of stay,
3. differences attributed to a combination of case mix and case specific average lengths of stay.

With respect to the first component, if its case mix had been treated at the region's average length of stay per DRG, Hospital 4's average length of stay would have been 6.96 days (column 5), for a difference of .188 days over the region (column 11). On the other hand, if case mix were standardized or all institutions were treating the same types of patients, hospital 4 would have had an average length of stay of 7.320 days (column 4), about a half day (column 10) longer than the region. Moreover, relative to the others, it would have had the longest length of stay. Thus, institution 4 has an average stay that is .708 days longer than the region, .188 days of which results from a more difficult case mix and .548 days results from longer DRG specific average lengths of stay.

The sign and magnitude of the interaction difference (column 12) is an indication of the extent to which the observed difference between an institution's and the region's average length of stay is accounted for by both case mix and DRG specific length of stay patterns jointly. It is that amount of the overall difference between the institutional and regional averages that cannot be allocated independently to case mix or DRG specific utilization. A large positive interaction might arise, for example, if the hospital has an average length of stay higher than the region in those DRGs where it treats proportionately more patients than the region or a lower than average length of stay in those DRGs with proportionately less discharges. In this instance, the particular patterns of the hospital's deviation from the region in both case mix and utilization by DRG contributed to it having a higher average length of stay.

The interaction difference is especially important to consider if its absolute value is large relative to the other differences (columns 10 and 11). Under these circumstances, one should not use the measures in the report for that hospital in comparison to the others. A large interaction indicates that hospital utilization patterns vary by case type and standardization would be misleading.

Referring to the information in Figure 6, hospital 4 has a small negative interaction component -.029. On the other hand, consider hospital 8, with an average length of stay 4.943 days or 1.828 days shorter than the region. The bulk of this difference is attributed to lower DRG specific utilization (-1.315 days), but also to a less complex case mix (-.986). However, note that these negative differences are partially offset by a half day (.473 days) attributed to the interaction of case mix and performance. In this instance, because of the relatively large interaction term, one should exercise caution in comparing this institution's standardized utilization measures (columns 4 and 5) with the other hospitals in the report.

In summary, then, the objective of the first stage is to examine institutional utilization over all cases, compare it to the region and other institutions, and get some understanding of the extent to which differences can be attributed independently to case mix and hospital utilization, as well as to their joint effect.

STAGE II

In the second stage our objective is to determine for each hospital, those DRGs for which it has a very long or very short length of stay as compared to the region. This is a two step process:

1. Initially a test is made for each DRG to determine if there is high inter hospital variation.
2. For those DRGs with high inter institutional variation, each hospital's mean length of stay is compared to the region's mean and large differences above and below are flagged.

Statistical algorithms used in this process are identical to those tests applied in a standard analysis of variance (ANOVA). That is, for each DRG one way ANOVA statistics are computed with hospitals forming the classes or comparison groups [11, chapter 10]. If the resultant F statistic is significant ($\alpha=.05$), then the DRG is flagged as having high inter hospital variation. Then for these DRGs, the hospital means are compared to the regional means to determine those which are high or low relative to the region. The criteria for high or low is determined using statistical procedures for comparisons among class means as described in Snedecor and Cochran [11, p. 268-278].

It is important to emphasize that the ANOVA and class comparison statistics are being applied here solely as screening mechanisms and should not be interpreted as tests of statistical hypotheses concerning the data. Data obtained from the PSRO regions typically cover the entire population of federal discharges, not a sample.

Two reports are used to summarize the results of this process. The first presents for each DRG with high inter hospital variation those hospitals with an average length of stay flagged as high or low relative to the region. A portion of this report for the sample PSRO region examined in Figure 6 is contained in Figure 7. It lists the DRG numbers (DRG) and the corresponding number of discharges (OBS) in the region for each group, followed by an abbreviated description of the DRG and the hospitals determined high and low by the algorithm.

The second report presents the same information organized by institution. A sample report for the same PSRO region appears in Figure 8. It presents the hospital identifier, the size or number of discharges used in the analysis, the DRGs for which the hospital's average length of stay was flagged as high, the DRGs for which the hospital's average was flagged as low, and then the difference between the number of high DRGs minus the number of low. Note here the results for Hospitals 4 and 8. Hospital 4 is higher than the region in 93 DRGs and low in 10, while Hospital 8 is higher in 5 and lower in 85.

In summary, the objective at this stage is to screen the database and identify for each institution those areas as defined by DRG where there may be potential problems in utilization.

STAGE III

In the final stage, specific DRGs are selected and analyzed in more depth, using the AUTOGRP interactive system to determine what other variables may contribute to the explanation of those differences.

DRG Reports for Institutional and Practitioner Profiles in PSRO Evaluations

One specific responsibility of PSROs is "profile analysis" - that is, the construction and review of relevant summaries of aggregated data pertaining to the care and services received by patients and provided by practitioners and institutions in the PSRO area. It is basically a descriptive analysis of health care and service patterns using measures and formats which serve to 1) facilitate the identification of exceptional areas of performance and 2) provide a mechanism of the ongoing monitoring of the overall system, with particular attention to previously defined problem areas.

While considerable latitude is given the PSRO for the format and content of a profile, there are three basic components to its design:

1. the patient group, which defines the scope of the profile in terms of the population to be analyzed,
2. the profile subjects, which define the subset of the patient group whose data is to be profiled; that is, aggregated and summarized in terms of some measures for comparative purposes with other profile subjects or the entire patient group,
3. the profile elements, which are the statistics or measures of interest to be displayed in the profile.

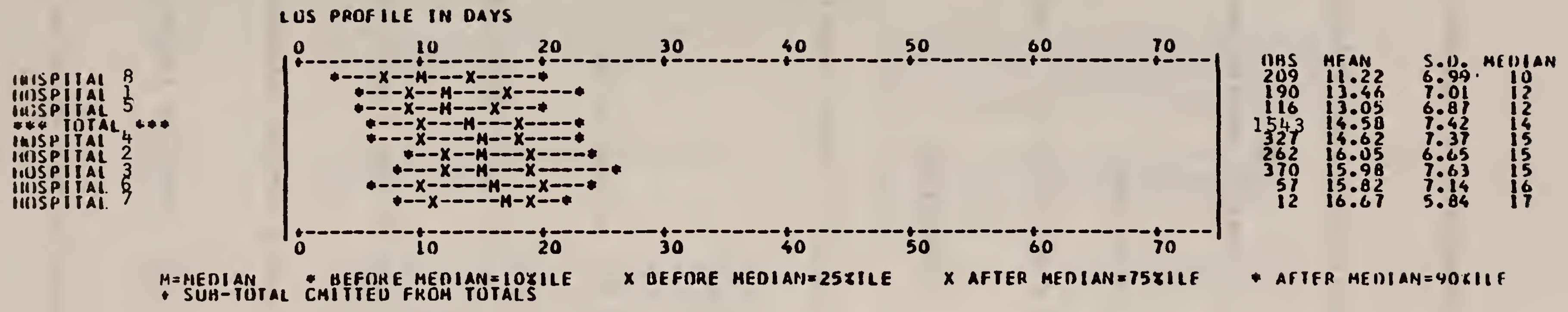
These three components are chosen to meet the objectives of the analysis to be performed. Of particular importance is the selection of an appropriate patient group, whose definition should control, to the extent possible, differences in the patient population which may affect the measures being displayed in the profile. For example, if a PSRO were interested in examining length of stay patterns for hospitals in its area, it would not be meaningful to form a group of patients from such diverse categories as normal deliveries, acute myocardial infarctions, gastric and peptic ulcers, and hemorrhoids. In this case it would be impossible to determine from the aggregate summaries whether particularly deviant patterns for institutions were attributed to differences in the types of patients they treat or to differences in their treatment practices.

The DRGs can therefore be an effective mechanism in profile analysis by providing a structure of consistent patient class definition within which institutional performance can be compared based on similar types of patients.

A series of reports have been programmed to produce summary statistics and institutional comparisons for each DRG. They are described extensively in "Diagnosis Related Group Reports for PSRO Databases."

An example of one report appears in Figure 9 and presents hospital length of stay performance patterns for DRG 121 - Acute Myocardial Infarction. A hospital identifier appears on the left, adjacent to a grid containing the median (m), the interquartile range (25th (first x) to 75th (second x) percentile), the 10th (first *) percentile, and 90th (second *) percentile of length of stay for each hospital. To the right of the grid are columns containing the number of discharges (OBS), the mean or average length of stay (MEAN), the standard deviation (S.D.) and the median (MEDIAN) length of stay or 50th percentile. In this example, the median length of stay for the region as a whole was two weeks or fourteen days. However, there was considerable variation among hospitals. Hospital 8 had a median length of stay of ten days, while hospitals 4,2 and 3 had medians of fifteen days. Further investigation in this area through medical care evaluation studies may be warranted to determine if there are quality of care problems in the short length of stay hospital or inappropriate utilization in the other three institutions.

As illustrated in the above example, these profiles can be useful in identifying potential areas of inappropriate utilization, which have lead to additional issues to address in quality of care. Since the overall number of DRGs is manageable and low compared to alternative classification by diagnosis or PAS group, sample sizes for individual hospitals in most cases were large enough to produce meaningful comparisons. Moreover, each group could be reviewed by PSRO personnel and a set selected for followup analyses.



```
                          LOS PROFILE IN DAYS

                           0         10        20        30        40        50        60        70
                          |+---------+---------+---------+---------+---------+---------+---------+----|   OBS   MFAN    S.D.  MEDIAN
HOSPITAL 8                |   *---X--M---X-----*                                                       |   209   11.22   6.99    10
HOSPITAL 1                |     *---X--M----X-----*                                                    |   190   13.46   7.01    12
HOSPITAL 5                |     *---X--M---X---*                                                       |   116   13.05   6.87    12
*** TOTAL ***             |      *---X---M---X----*                                                    |  1543   14.58   7.42    14
HOSPITAL 4                |      *---X----M--X----*                                                    |   327   14.62   7.37    15
HOSPITAL 2                |         *--X--M---X----*                                                   |   262   16.05   6.65    15
HOSPITAL 3                |        *---X--M---X------*                                                 |   370   15.98   7.63    15
HOSPITAL 6                |      *---X-----M---X---*                                                   |    57   15.82   7.14    16
HOSPITAL 7                |        *--X-----M-X--*                                                     |    12   16.67   5.84    17
                          |                                                                            |
                          |+---------+---------+---------+---------+---------+---------+---------+----|
                           0         10        20        30        40        50        60        70

                M=MEDIAN    * BEFORE MEDIAN=10%ILE    X BEFORE MEDIAN=25%ILE    X AFTER MEDIAN=75%ILE    * AFTER MEDIAN=90%ILE
                + SUB-TOTAL CMITTED FROM TOTALS
```

Figure 9

Sample Institutional Length of stay Profile
for Acute Myocardial Infarction Patients

Figure 7

DRG	OBS	
109	1010	Dis of eye w myectomy, blepharorrhaphy, oth minor oper High: 4 Low: 1
110	3881	Dis of eye w extraction lens, sclerotomy, sclerectomy High: 1,6,7 Low: 2,3,8
111	512	Dis of eye w reattachment of retina, keratoplasty High: 4 Low: 3,5
113	151	Labyrinthitis, meniere's dis wo oper High: 1
114	275	Dis of ear w myringotomy, adenoidectmy or oth minor oper High: 4,6 Low: 2
115	225	Dis of ear w stapectomy, tympanoplasty High: 4,6 Low: 2
119	151	Malig hypertensn, hypertensive dis (heart renal) wo oper w major dx2 High: 5,6
121	1549	Acute myocardial infarction High: 2,3 Low: 1,5,8
122	407	Ischemic heart dis except ami wo oper wo dx2 High: 5 Low: 8
123	948	Ischemic heart dis except ami wo oper w minor dx2 High: 3 Low: 2,8
124	2829	Ischemic heart dis except ami wo oper w major dx2 High: 1,3 Low: 2,6,8
125	803	Ischemic heart dis except ami w cardiac catheterization High: 2 Low: 8
126	452	Ischemic heart dis except ami w endoscpy insertn of electr device High: 3,5 Low: 8
128	468	Arrythmia & slowed conduction wo oper wo dx2 or w minor dx2 High: 4 Low: 8
129	498	Arrythmia & slowed conduction wo oper w major dx2 High: 4 Low: 8

PSRO Database Screening by DRGs

Hospital	Size	DRGs for which hospital's los is significantly high	DRGs for which hospital's los is significantly low	Difference: #High - #Low
1	12,666	17,21,27,29,59,62,65,73,76,93,110,113, 124,143,146,159,177,211,218,239,241, 264,265,266,267,271,278,282,290,292, 294,311,318,324,328,340,358,380	4,5,6,36,38,91,92,94,109,121,160,170 172,175,201,224,254,255,295,297,302	17
2	24,049	76,93,94,121,125,137,160,175,184,198, 199,224,227,228,242,254,282,320	5,27,32,54,83,91,96,99,110,114,115,123, 124,131,140,158,159,163,164,167,170,171, 176,182,249,251,264,265,268,278,281,293, 296,311,324,325,333,355,372,380,382	-23
3	14,117	35,121,123,124,126,140,158,159,245, 257,268,339,369	29,50,54,56,59,71,76,90,91,92,95,104, 105,110,111,144,166,170,172,197,198, 199,201,204,254,255,265,266,278,290, 294,297,318,352	-21
4	41,643	3,4,11,23,27,29,36,38,50,54,62,71,76,89, 90,91,92,93,95,96,98,99,100,104,105,109, 111,114,115,128,129,131,132,140,143,144, 145,158,161,163,164,166,180,182,185,197, 198,199,201,202,204,205,216,220,227,242, 249,254,255,264,265,266,268,278,279,281, 282,283,289,290,293,294,296,297,300,302, 305,307,311,318,323,325,326,331,334,335, 348,350,352,355,363,381,382	35,170,171,172,174,177,241,320,321,333	83
5	5,499	17,119,122,126,164,211,265	3,5,75,99,111,121,144,158,166,170, 174,198,216,266,300,305,323,348,352, 369,381	-14
6	8,167	73,75,110,114,115,119,158,159,160,189, 197,198,224,251,264,282,289,296,297, 300,326,372,377,382	91,124,144,170,171,176,184,220,278,281, 307	13
7	2,828	110,135,167,227,229,265,267,271,328	23,93,94,170,233,235	3
8	20,494	56,216,265,320,321	3,4,5,6,27,59,62,76,91,98,99,100,110,121, 122,123,124,125,126,128,129,131,132,135, 137,143,144,145,146,157,158,159,161,167, 168,170,171,173,176,177,180,185,195,197, 198,199,202,205,211,218,227,228,229,242, 254,257,266,267,271,278,279,281,282,289, 290,293,294,295,296,297,300,302,307,318, 323,326,333,335,340,348,358,363,377,379.	-80

Figure 8

3.3 EVALUATION AND RECOMMENDATIONS CONCERNING BATCH REPORTS

In addition to the reports presented here in the context of an analysis strategy for identifying potential utilization problems, a number of other reports were also programmed providing descriptive statistics by DRG for the PSRO as a whole. These reports include length of stay histograms, frequencies of discharges, mortality rates, number of bed days, used and cumulative distributions of DRGs by discharges and by bed days consumed. A detailed description of the contents of these reports appears in Appendix B.

In general, the reports were used to a very limited extent by the participating sites. Various reasons were cited for their low utilization, which related to either the DRGs or the design of the reports themselves (refer to Section 4 of this report). First, the DRG concept has not been widely understood or accepted by the physician community. Second, when attempts were made to conduct analyses by DRGs, the contents of certain groups appeared to lack medical consistency and did not reflect the brief description provided with the reports. Third, the sheer volume of the reports was a formidable barrier to overcome in reviewing the material. Finally, with respect to the design of the reports, too much information was contained on a page - much of it with limited utility.

In response to these comments from the PSROs, we have written a paper containing a comprehensive description of the development of the DRGs, (Section 3.1) and revised their titles to reflect more accurately their contents (Appendix A). In this section we wish to indicate changes in design based on our experience. We recognize that the volume is far too great and that their utility could be greatly enhanced by providing a sequence of analyses which successively move from macro to micro problem identification.

Case Mix Report

Perhaps the mose useful single result from a batch analysis is the Case Mix Report which compares length of stay among hospitals and to the region by standardizing for case mix and performance. The details of the method are given elsewhere, (Section 3.2) but it shows relatively clearly whether in the aggregate a hospital's los difference can be explained by differences in case mix (the extent to which it treats different patients) or by differences in performance (the extent to which it treats similar patients differently). As demonstrated by reports from the sites (Section 4), it has been used by a number of them to focus on particular hospitals which were found to be significantly aberrant in utilization from their peers.

We recommend that this kind of analysis and report be extended to include other dependent variables (death rates and ancillary service costs, for example) and that it be produced on a continuing basis for PSRO use.

LOS and Bed-day Statistics

Other reports provide los and bed-day results by DRG for the region and then for each hospital compared to the region. These reports should not be routinely produced, but only for a hospital for which some other indication of problems has been obtained. The regional report should only give by DRG, number of patients, bed-days, los statistics, and death rates and should present PSRO data compared to regional and national data. As it stands it is not useful and needs major revision. A report designed to compare the PSRO annually or semi-annually with PSROs in its region and nationally and ranked in terms of activity would allow PSROs more effectively to identify problems in their area. This cross PSRO dimension is essential to system improvement.

When a specific hospital report is required, it should be produced on the same basis as given above for the regional report, but should only address those DRGs for which there is sufficient activity to make comparison meaningful.

Case Mix Composition

The Case Mix Composition report for the PSRO has not proved of value given other information available and should not be produced.

DRG Profiles

These can be useful to the PSRO but need major revision. First, based on an analysis of variance, only those profiles for which there is significant inter-hospital variation should be produced at all. Further, hospitals with too little case activity to provide comparison should be eliminated from the profile. The hospitals which are significantly high or low should be marked and the difference reported. Death rates should be computed for all sample sizes, significance tests performed, and results of these tests reported. Finally, the rank results have not proved useful and should be eliminated.

The "high-low" reports which are described elsewhere (Section 3.2) should be included as an explicit part of the case mix package and some form of WISPRO's utilization index also reported. For this, each PSRO will have to determine appropriate peer groups so that comparisons will be most meaningful in each setting. The reporting system should include some version of the COMPARE command available interactively in AUTOGRP so that such reports could be ordered as part of any batch package.

4.0 PROCEEDINGS OF THE DECEMBER 1978 USER'S FORUM

A conference was held December 7-8 at the Center for Health Studies, which was attended by representatives from the participating sites (except the South Carolina Medical Care Foundation) and invited members from other PSROs who have been using the system, including the Essex Physicians Review Organization and the New York County Health Services Review Organization. Participants were asked to report on how they have used the system to analyze their data and what followup activity was taken as a result of this information. These presentations were taped and this section contains edited versions of those talks, including questions and comments from the other conference participants.

These presentations revealed that the system continued to be useful in ways similar to those reported in earlier conferences, namely, in responding rapidly to requests for information, in identifying or substantiating suspected problems in utilization, in focusing on areas of practice which appear to be deviant from the community norm, in detecting patterns of utilization which deserve detailed study, and in providing an ongoing monitoring capability as a control on the delivery of institutional acute care services within its responsibility. However, it was also noted that the utility of the data accessed by the system had greatly increased in terms of action taken as part of the followup activities. In particular, several organizations reported on structured processes they had established for the flow of information - from distribution and presentation to the institutions to action oriented mechanisms on the part of the PSRO to implement change. In this regard, note in particular the Hospital Evaluation Plan developed at the Multnomah Foundation For Medical Care, which has integrated the AUTOGRP system very effectively into its total data management/analysis process. Also, the Colorado Foundation for Medical Care presented their procedures for handling the hospital profiles produced with the COMPARE capability.

There were also strong indications that the PSROs are becoming a valuable resource as a source of data for outside agencies as well as for the institutions under its responsibility. The Central Massachusetts Professional Standards Review Organization, for example, was able to provide the area Health Systems Agency with relevant information pertaining to the use of psychiatric beds. Also, the Colorado Foundation for Medical Care shared non-confidential information with a governor appointed task force to investigate possible abuses of electro-shock therapy.

In general while limited use was made of the DRG batch reports described in Section 3, the Case Mix Analysis Report was applied extensively by the Wisconsin Professional Standards Review Organization (WISPRO). WISPRO developed their own index of utilization based on information in the report. This index was then used in the criteria for the focused review program and in setting the year's objectives.

Finally, the most often cited use of the system was in profile analysis, especially with respect to focused review. The Multnomah Foundation reported using the system in the construction of their hospital and physician profiles.

In addition, they found the PROFILE capability helpful in determining areas for waived review. The Colorado Foundation used the COMPARE capability extensively as part of their institutional profile process. All the other participating and non participating project sites also presented examples of how they had used the system in generating physician and institutional profiles.

CENTRAL MASSACHUSETTS PROFESSIONAL STANDARDS REVIEW ORGANIZATION

Richard Kaplan and Barbara Ladon

Richard Kaplan:

Background

The Central Massachusetts PSRO has sixteen hospitals, approximately 41,000 annual federal discharges, 600 physicians, and has had multiple data collection resources in the past. In Massachusetts we had to rely on the Massachusetts Hospital Association and a set of merge reports that they generated for some of their hospitals. We also have two hospitals that generate their own tapes. One of these hospitals is our largest hospital with a good proportion of our federal discharges. All of that began to change about six months ago when we told the hospitals that used MHA, to use our abstract and they did. It was not an easy process, but they all now use our abstract. We continued to use Dikewood as our processor. However, that too will change on the first of January when Puter Associates will pick up as our data processor. Under this new arrangement, we will ship our abstracts to New Haven, where they will be entered. We will not have a mini system like some of you have in your offices. Our numbers, discharges, are not enough to support that system at this point in time.

We have been one of the demonstration projects and have used the AUTOGRP system for utilization review purposes as most of you have. Neither Barbara nor myself is going to talk about that. We plan to discuss AUTOGRP applications from the past year and a half in three particular areas. First, we have done a lot of work on MCE analysis and Barbara is going to present some appendectomy results from our last MCE. Second, we are also one of the ambulatory care demonstration sites and have used AUTOGRP under a separate contract, not through the demonstration project per se, for the analysis of some of our ambulatory care data. Finally, the topic I am going to discuss is our use of AUTOGRP for HSA relevant information.

Analysis of Psychiatric Admissions for the HSA

Our HSA is almost contiguous to the area served by the PSRO. All of the major hospitals are included. It comprises Worcester County, which is a county of close to three quarter of a million people and runs the full length of the state, north to south. They have one additional hospital that we do not have - it is a small rural hospital.

The first question that the HSA had for us dealt with psychiatric admissions. One of the issues in their health systems plan relates to admissions to non-licensed psychiatric beds for psychiatric admissions. They have made a decision that the admissions for psychiatric patients to non-licensed psychiatric beds is inherently bad i.e., that psychiatric patients should be treated in a psychiatric setting. The critical issue with the HSA was what was happening with the patients who were admitted to non-licensed psychiatric beds. Were they going in, staying for a long length of time and going home, or were they as the hospital had said, going in for short periods of time in an emergency state and then being transferred to psychiatric settings when a bed became available or when their concomitant medical problems were taken care of.

The HSA came to us to examine our data regarding these questions. Our data revealed many different psychiatric diagnoses, with small numbers of observations. We told them we had other kinds of capabilities that would allow them to look at the data somewhat differently. All of the diagnoses were in six DRGs. We asked if those would be sufficient for their review of the information, and they agreed. They were not concerned about the total length of stay for the patients. Rather they were more interested in the discharge status of these patients and what was happening to them. They thought that length of stay was only to be used as an indicator for transfers. We selected all discharges from July 1, 1977 through December 31, 1977. The reason we chose that time frame is that any data collected prior to July 1, 1977 is loaded with errors and not worth analysis.

We have a memorandum of understanding with the hospitals which states that before any data is released to the HSA they have a thirty day comment period prior to us submiting data to the HSA. The thirty day period comes up next week and we have not yet received anything from any of the hospitals. There are four hospitals in our area that have licensed psychiatric beds and twelve hospitals that do not. For each psychiatric DRG we provided the following information:

(1) the length of stay profile;
(2) display of admission diagnosis;
(3) distribution of discharge status.

Again, the discharge status was the most critical factor to the HSA. We wanted the admission diagnosis to pick out the concomitant medical problems. Specific profiles were generated for every hospital.

Before I show the first transparency let me discuss one thing about the database. It is incomplete because hospitals are represented for different time periods. They were all under review but our database does not contain data for some months. In particular, one of the four hopsitals with licensed psychiatric care is underepresented. The utilization is, therefore, not complete, but the data covers everything that we had when we ran the report. There were a total of 16,000 patients, 289 of which were psychiatric patients or 1.8 percent. I think the numbers would change drastically if we had that other institution with licensed psychiatric beds. It is also the largest psychiatric unit in the area.

We ran a length of stay profile by hospital (Figure 1) for all psychiatric patients. The mean length of stay was ten and one half days, with considerable variations noted among hospitals. Next, we examined the length of stay for hospitals without licenced psychiatric beds (Figure 2). We anticipated short lengths of stay and in and out transfers, but that is not what we found. While the mean for the total was ten and one half days, the means for these hospitals were about eight and one half days.

The next question considered was the discharge status of these patients, the really critical indicator. As one can see, the bulk of the patients were not going to either short term facilities or psychiatric facilities, but returning home. A few died. An examination of the admission diagnoses reveals that most of the patients had some form of psychiatric disturbance (Figure 3). They did not have concomitant medical problems. A very small percentage had what we would have considered medical problems.

We then examined the length of stay profiles for the four hospitals with licensed psychiatric beds (Figure 4). This is the other side of the picture. The average length of stay is thirteen and one half days as compared to 8.6 days for non-licensed institutions. Most of the patients returned home, although in fact twenty percent went to some type of short term facility which could have included a half-way house or some other setting not defined as a psychiatric facility. This was not the case for the non-licensed institutions. Profiles were then generated for every hospital, which included the length of stay distribution, a display discharge status, and a display of admission diagnosis (Figure 5).

This same profile was run for every institution and the information sent back to them. The HSA was concerned with one hospital. They wanted to know why at this institution without any psychiatric service there are a large number of psychiatric patients. In one six month period a large number of psychiatric patients were admitted, so they notified us of their concern that there was not adequate coverage for the patients. There were no house officers. Who sees to the needs of the psychiatric patients at that institution? And, from a quality point of view, was that an appropriate way to do things? There is great divergence among the psychiatric specialists as to the most appropriate place for treatment of not acutely ill psychiatric patients who are mildly disturbed. Is it better to treat them in a homogeneous setting or a heterogeneous setting? The Department of Public Welfare is assuming that the psychiatric population has to be segregated. The psychiatrists now are questioning if this is the most appropriate way. Maybe it is best to place that patient in a community hospital. We have not answered the question - the hospital was reasonably concerned that we brought it up as an issue but felt that they were not doing anything that their physicians considered poor medical practice. We could not argue with that because of the divergency of our specialty group on the best way to take care of patients.

This study was given high priority by two requests, one from the HSA, one from the Department of Welfare. Indeed, the final report has now gone to the HSA while we hopefully will get it out soon after that thirty day comment period is over. I do not know what the HSA is going to do with the information. I will say that I believe it is the first time in Massachusetts that the PSRO has been able to provide an agency with information on what is happening in hospitals.

Barbara Ladon
Medical Care Evaluation Study

We have begun performing analysis on utilization data and have done many of the kinds of studies that you have seen here. However, we chose not to present them simply because we feel that a lot of you have done the same kind of studies or are going to see it from other people. In particular, we have done a cataract study, a hernia study, and a few other studies, and we are starting to show them to our hospital performance committee. I did not think I would have time today to talk about the ambulatory care project. We did some exciting things regarding that project, if anyone wants to talk to me later. We are trying to do some longitudinal tracking of patients, which is different, but the system has allowed us to do that. And. we have had the capability of being able to follow up on some of the physician's requests without waiting six months for the batch report.

As many of you here are aware, we have a very strong area-wide medical care evaluation system. We are about to finish our fourth area-wide MCE. The first study we performed had over a thousand records, which were analyzed manually. That was absurd. There is no other way to put it. The second study we analyzed on the AUTOGRP system. The data were entered by PSRO staff directly at the terminal. The staff encountered a number of problems with that.

For the third study we had the data keypunched and sent down to Yale for conversion to an AUTOGRP file. We have been analyzing it interactively and I would like to show you some of the things we are doing. We developed the forms, the procedures and the criteria. Up until now the hospitals have collected the data themselves on our form. Unfortunately, we have found disparities even as strict as we had the system set up. So for this last set we are doing now, which is the laminectomy study, we have hired a person who is doing all the data collection in all the hospitals. The hospitals are still responsible for the analysis feedback route if they want to have the information for JCH.

Appendectomy Study

Some of you may have heard one of our physicians, Dr. Brewster, and others speak about staging criteria. We are trying to use the staging concept in our appendectomy study. In stage 1 there were no clinical findings, a negative pathology report, normal temperature, and normal white blood cell count. By the criteria definitions, with stage 2 there was again no sign of appendicitis in the patients who came to the hospital, but the white blood count was elevated. Stage 3 patients had appendicitis and stage 4 had appendicitis with peritonitis. We are comparing this to the DRG classification of appendicitis, which really makes the break on peritonitis or not peritonitis.

What I want to present now is a sample of some of the analyses we have performed. While we have certainly done more than I will show, these examples represent some of the things that physicians found useful. This is the percentage of patients in combined stages 1 and 2 by hospital (Figure 6). These are patients who had appendectomies but did not have appendicitis, with or without clinical signs. There are two very small hospitals in this study with small numbersof appendectomies. In one case fifty-eight percent had a normal pathology report, but there were only seven patients. Our physicians are having some difficulty deciding what to do when the total case load is so low and is the total case load for the year. Note there are some really wide differences. We just had a meeting this week and those charts are all being reviewed. According to the literature, normal appendix rate should be somewhere between 10-20 percent. This takes into account pathology department differences, patient differences, and clinical differences. We plan to focus on the areas above and below that by, for example, examining the final discharge diagnoses. Our objective is to determine the kinds of things we should look at in the hospital to try and solve this problem.

With respect to the distribution of discharge diagnoses, 17 percent of the stage 1 patients and 26 percent of the stage 2 patients had diagnoses that were gynecological related (Figure 7). This is somewhat unevenly distributed among hospitals who have that information and they are thinking of asking for some consults on certain patients for that group. The thing that they were very interested in is the number of patients who did not have appendicitis by the pathology, and yet their final discharge diagnosis was acute appendicitis. We have a pathologist on our committee who said that he would like to work on that further.

Q. Were there any incidental appendectomies in this study?

A. No. There were no incidental appendectomies in this study,

Q. Are the diagnoses indicated here primary diagnoses or do you look for further diagnoses? In other words, could the diagnoses have been in the wrong order?

A. They did not have acute appendicitis. Each had an appendectomy but by the clinical definitions used in the literature, they did not have appendicitis. The pathology report indicated there was no sign of appendicitis.

Q. How were you able to analyse by diagnosis - probable or secondary?

A. We subsequently asked for the probable diagnosis on the abstract. All of MCE's are for all patients and there is a large number of non-federal patients especially in the appendicitis group. There are a lot of young people so we were collecting the data base entirely from scratch on this one.

Q. Do you use the system to identify topics?

A. Yes. I am not sure it worked out the way I wanted it to but the answer is yes. In our first hospital performance committee meeting we took some of the profile data from the RANK report. We presented a AMI DRG and showed them the disparity in length of stay and mortality rates across the hospitals. We were looking, for some decisions there on the spot. The response was to do an MCE, which we are not sure was what we wanted, but that's what we got out of this one. I think that is a positive response to the data. The other way we have used the system is to identify groupings of patients, large enough groups that seem cohesive, that we can go in and do further studies where there were disparities in some outcome measures as length of stay and mortality.

Q. Will you be sharing these profiles with the hospitals?

A. Yes. These profiles will go to the hospitals. We just did a transfusion audit and for one or two of the hospitals some of the profile reports were presented pretty much as they came out of the computer.

Finally, I would like to show you one more thing that we are sending to every hospital. The physicians asked for this. It is a hospital profile. This one was generated using SEARCH-ORDER-REPORT, with a few percentages manually computed. We have done this for every single hospital district, to be provided to every hospital. The committee's position was here's some information that will help you analyze your data, which you have never had the opportunity to examine. The physicians in this case gave the number of patients, the distribution across stages, complication roles, mean number of preoperative hours, and mean length of stay. These means are considerably different across physicians. While this involved a lot of work, the committee felt hospitals needed to start looking at data in a more organized way. With the exception of the two institutions who have their own computer, the hospitals have not had these capabilities in the past.

Length of Stay Profile for all Psychiatric Patients

```
HOSP  0         10        20        30
     :+---------+---------+---------+---------!    SIZE      MEAN     S.D.   MEDIAN
  2.   *M--*                                  !       3      2.67     2.08     2.00
  4.   *--M*                                  !      22      5.18     7.17     3.50
 16.     *M-------*                           !      17      6.53     5.20     4.00
 12.     *M------*                            !       7      5.86     3.58     4.00
 15.      *M*                                 :      11      5.09     1.76     5.00
  3. :   *--M*                                !       2      5.50     2.12     5.50
  8.      *-M-*                               !       7      6.86     5.27     6.00
  5. :  *---M------*                          !       6      7.17     5.38     6.00
  9. !   *--M----*                            !       4      6.50     4.12     6.00
  6. !    *-M--*                              !      23      7.70     5.87     6.00
  7. !     *--M-----*                         !      52     11.77    12.26     7.50
 11. !     *--M------*                        !      21     10.24     7.81     8.00
 14. !  *-----M--*                            !      39      8.51     8.05     8.00
 13. !                                        !
 10. !           *----M------*                !       5     16.60     7.27    16.00
  1. !        *------------M---------*        !      47     20.77    14.10    21.00
 AL  !    *--M------*                         !     289     10.55    10.43     7.00
     :+---------+---------+---------+---------!
      0         10        20        30
```

Figure 1

Length of Stay Profile for Hospitals without
Licensed Psychiatric Beds

```
HOSP  0         10        20        30
     :+---------+---------+---------+---------!    SIZE      MEAN     S.D.   MEDIAN
  2. ! *M--*                                  !       3      2.67     2.08     2.00
  4. ! *--M*                                  !      22      5.18     7.17     3.50
 16. !   *M-------*                           !      17      6.53     5.20     4.00
 12. !   *M------*                            !       7      5.86     3.58     4.00
 15. !    *M*                                 !      11      5.09     1.76     5.00
  3.     *--M*                                !       2      5.50     2.12     5.50
  8.      *-M-*                               !       7      6.86     5.27     6.00
  5.    *---M------*                          !       6      7.17     5.38     6.00
  6.      *-M--*                              !      23      7.70     5.87     6.00
  7.       *--M-----*                         !      52     11.77    12.26     7.50

 11. :     *--M------*                        !      21     10.24     7.81     8.00
 10.             *----M------*                !       5     16.60     7.27    16.00
 TAL !    *-M----*                            !     176      8.63     8.75     6.00
     :+---------+---------+---------+---------!
      0         10        20        30
```

Figure 2

Display of Admission Diagnosis for Hospitals without Licensed Psychiatric Beds

IDER)BS.	PCT	MEAN LOS	S.D LOS	ADX CODE	
14	7.95%	10.64	12.94	7902	DEPRESSION
13	7.39%	4.31	2.90	3000	ANXIETY NEUROSIS
10	5.68%	9.50	7.20	3004	DEPRESSIVE NEUROSIS
8	4.55%	12.38	7.96	3039	OTHER AND UNSPECIFIED ALCOHOLISM
7	3.98%	8.00	2.52	2962	MANIC DEPRESSIVE PSYCHOSIS, DEPRES
7	3.98%	8.57	6.48	2959	SCHIZOPHRENIA-UNSPECIFIED TYPE
5	2.84%	10.00	12.31	7825	-SYNCOPE OR COLLAPSE
5	2.84%	13.00	11.36	3099	DIS,NOT PSYCHOTIC,PHYS CONDIT-OTHE
4	2.27%	7.25	5.19	7800	-COMA AND STUPOR
4	2.27%	7.25	5.85	2969	AFFECTIVE PSYCHOSES-UNSPECIFIED
4	2.27%	12.50	5.20	4129	CHRONIC ISCHEMIC HEART DISEASE-WIT
4	2.27%	2.75	1.26	3173	NO-CODE
3	1.70%	4.33	.58	2961	MANIC-DEPRESSION PSYCHOSIS, MANIC
3	1.70%	3.67	1.53	7837	SYMPTOMS REFERABLE TO RESPIRATORY
3	1.70%	20.00	21.70	2958	SCHIZOPHRENIA-OTHER
3	1.70%	7.33	5.77	2982	REACTIVE CONFUSION
3	1.70%	22.33	25.81	299	UNSPECIFIED PSYCHOSIS
3	1.70%	8.33	6.81	2900	SENILE DEMENTIA
3	1.70%	11.33	7.51	9779	BAD EFFECT OTH DRUGS-DRUGS, UNSPEC
3	1.70%	2.67	2.89	3040	DRUG DEPENDENCE-OPIUM, OPIUM ALKAL
2	1.14%	10.00	.00	2509	DIABETES MELLITUS-WITHOUT MENTION
2	1.14%	4.00	.00	486	PNEUMONIA, UNSPECIFIED
2	1.14%	1.00	.00	264	ASCORBIC ACID DEFICIENCY
2	1.14%	5.00	.00	0089	ENTERITIS DUE TO OTHER SPECIFIED O
2	1.14%	3.50	.71	3069	SPECIAL SYMPTOMS NOT ELSEWHERE CLA
2	1.14%	6.00	.00	437	GENERALIZED ISCHEMIC CEREBROVASCUL
2	1.14%	4.00	.00	4369	ACUTE BUT ILL-DEFINED CEREBROVASCU
2	1.14%	15.00	.00	5192	-OTHER DISEASES OF LUNG
2	1.14%	4.00	.00	4109	ACUTE MYOCARDIAL INFARCTION-WITHOU
2	1.14%	2.00	.00	7960	UNKNOWN CAUSES,MORBID & MORTALITY-

Figure 3

Length of Stay Profile for Hospitals with Licensed Psychiatric Beds

```
HOSP  0         10        20        30
     I+---------+---------+---------+---------I    SIZE    MEAN      S.D.   MEDIAN
   9.I   *--M----*                            I       4    6.50      4.12     6.00
  14.I  *-----M--*                            I      39    8.51      8.05     8.00
 *13.I                                        I
   1.I        *------------M---------*        I      47   20.77     14.10    21.00
TOTALI     *---M----------*                   I     113   13.54     12.05     9.00
     I+---------+---------+---------+---------I
      0         10        20        30
```

Display of Discharge Status for Hospitals with Licensed Psychiatric Beds

```
NUMBER            MEAN       S.D   DSTAT
 OBS.     PCT      LOS       LOS   CODE

   77   68.14%   14.88     13.29   1 HOME
    2    1.77%    4.00      2.83   2 AMA
   23   20.35%    8.87      4.39   3 SHT_TRM
    5    4.42%   19.20     17.43   4 PSY
    3    2.65%   16.33      7.09   6 ICF
    1     .88%    7.00       .00   8 HLTH_SERV
    2    1.77%   10.00      2.83   9 DEAD
```

Figure 4

Length of Stay Distribution for Psychiatric Patients

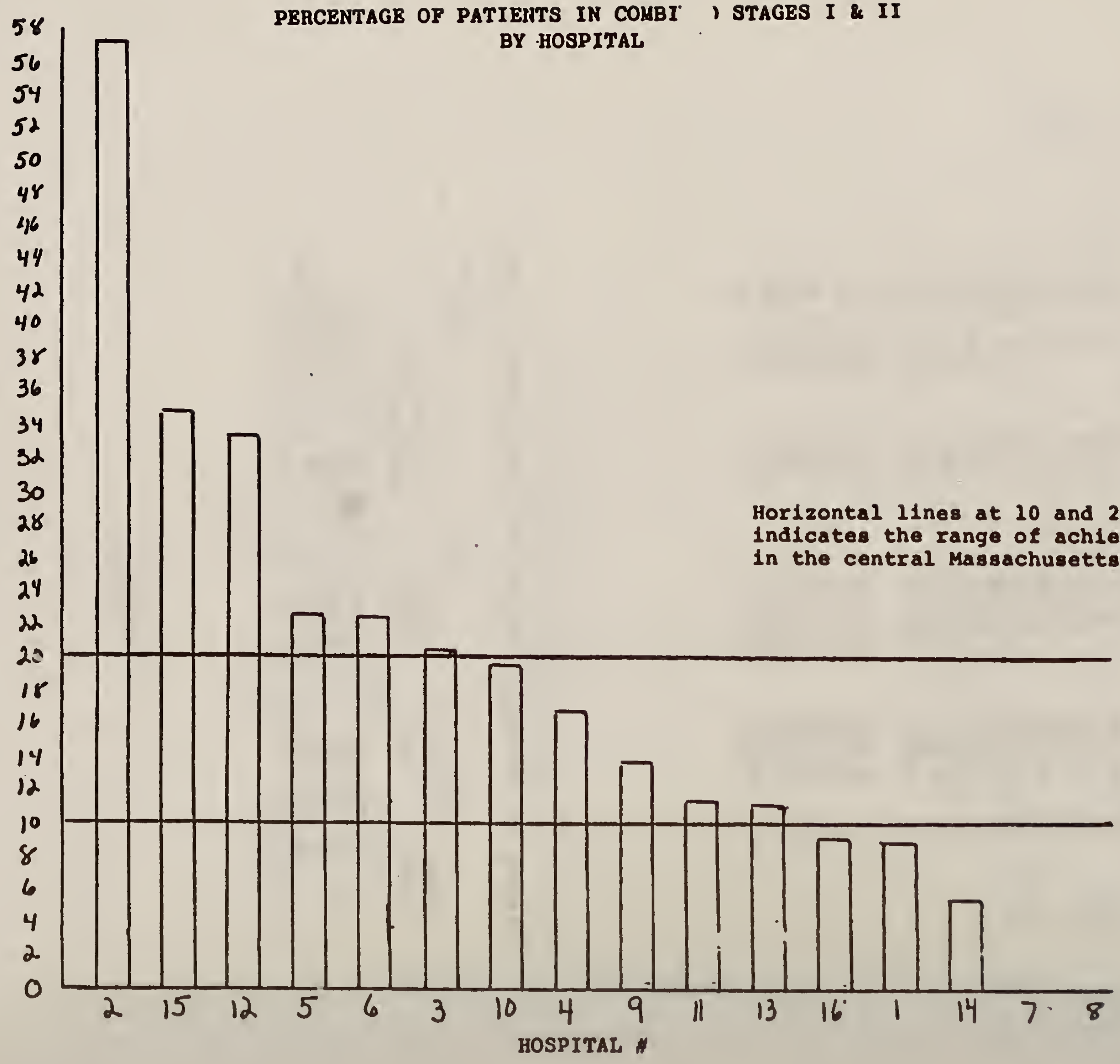
NUMBER OBS.	PCT	MEAN LOS	S.D LOS	LOS CODE
6	12.77%	1.67	.52	0 - 2
3	6.38%	3.67	.58	3 - 5
3	6.38%	6.67	1.15	6 - 8
2	4.26%	9.50	.71	9 - 11
3	6.38%	12.67	.58	12 - 14
4	8.51%	15.50	.58	15 - 17
2	4.26%	18.50	.71	18 - 20
5	10.64%	22.40	.89	21 - 23
2	4.26%	24.00	.00	24 - 26
3	6.38%	27.67	.58	27 - 29
4	8.51%	31.00	.82	30 - 32
1	2.13%	34.00	.00	33 - 35
1	2.13%	38.00	.00	36 - 38
3	6.38%	39.67	.58	39 - 41
3	6.38%	43.33	1.15	42 - 44
2	4.26%	45.50	.71	45 - 47

Display of Discharge Status for Psychiatric Patients

NUMBER OBS.	PCT	MEAN LOS	S.D LOS	DSTAT CODE
44	93.62%	20.98	14.28	1 HOME
1	2.13%	6.00	.00	2 AMA
1	2.13%	15.00	.00	3 SHT_TRM
1	2.13%	32.00	.00	4 PSY

Figure 5

PERCENTAGE OF PATIENTS IN COMBI') STAGES I & II
BY HOSPITAL



Horizontal lines at 10 and 20 percent indicates the range of achievable rates in the central Massachusetts area.

Figure 6

Distribution of Discharge Diagnoses of Patients in Stages I and II

Diagnostic Category	#Stage I Patients	%Stage I Patients	#Stage II Patients	%Stage II Patients
Gastrointestinal Diagnoses	7	11.2%	4	7.6%
Gynecological Diagnoses	11	17.7%	14	26.4%
Mesenteric Adenitis	19	30.6%	11	20.8%
Peritonitis	1	1.7%	0	0
Appendicitis : Acute	8	12.9%	17	32.1%
Other	10	16.2%	6	11.2%
Other Appendix Disease	6	9.7%	1	1.9%
Totals	62	100%	53	100%

21.7% of all Stage I and II Patients had Gynecological discharge diagnoses, primary surgical procedure: appendectomy.

21.7% of all Stage I and II Patients had discharge diagnoses of Acute Appendicitis Pathology report was negative for all cases.

Figure 7

COLORADO FOUNDATION FOR MEDICAL CARE

Suzanne Zimmer

Background

The Colorado Foundation is a statewide PSRO with five regional offices to help us manage our huge geographic area. We now review 83 acute care hospitals, 12 specialty hospitals and that amounts to approximately 130,000 federal discharges in a year, and a very large database. We have been in this project from the beginning but in this last year we have seen a tremendous increase in our reliance on the AUTOGRP system. In fact, in the last year all our special studies have used AUTOGRP, either in the interactive mode or in the batch mode, except for one major study on our readmission rates which AUTOGRP was unable to handle at this time. There is no doubt that we have been able to respond a great deal more to a variety of requests for data with the use of AUTOGRP.

The flexibility and the timeliness have helped us a great deal, particularly in responding to groups outside of our own PSRO, which is important in view of current issues concerning sharing of data. A good example involves an issue which is, at present, quite controversial in Colorado - electro-shock therapy. We have a citizens' right group who is very active in this particular area, so active that the governor appointed a special task force to hold public hearings and determine whether or not there were abuses, and whether there should be legislation passed to control the use of electro-shock therapy. This task force approached us a couple of months ago. After having had public hearings and taking the testimony of individuals concerning alleged abuses, they wanted to know what our PSRO data could provide since we collected ECT as one of our procedures. They had some very specific ideas as to what kinds of data they wanted and how they wanted it displayed, by hospital, sex, and age. Since the request did not include confidential information, we were able to provide the data by simply sitting down at the terminal, structuring exactly what they wanted, and xeroxing the AUTOGRP output for presentation to the Task Force. They have not yet made any decisions and are still in consultation about the public hearings and our data, but they were very appreciative of the information we were able to give them.

DRG Batch Report Analysis

We have also used the GAC reports.* For example, with the RANK Report we were able to help a group in the state health department that is working on diabetes control.** They felt that the information by DRG was most useful in their study. In our own organization I have to admit we are having a great deal of trouble with acceptance of the DRG concept by our physicians and operational people. This has been the major drawback to full utilization of the AUTOGRP system. The group analysis capability reports would have been extremely useful if the basic premise of the DRGs were accepted. I am not sure if we have failed in the educational area, although we have tried to explain the DRG system time and again to various departments and committees in the Foundation. Mr. Fetter has generously explained the concept to all levels of our administration and physician committees on at least three occasions and still there is a resistance to using anything other than individual diagnoses or PAS groups. The group analysis reports have been used mostly within our own data division as partial background for choosing diagnoses on which we want to focus. If a given DRG appeared to be a problem area, our Review Program Department chose to focus on the primary diagnosis, ignoring any secondary diagnoses or operations which might be part of the DRG.

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*The GAC reporting system predated the current system for producing DRG reports. While the system has been altered considerably, the term "GAC reports" is still often used to refer to DRG reports in general.

**The RANK report consists of the hospital length of stay profiles by DRG described in Section 3.

Batch AUTOGRP Analysis

We have used the batch mode a great deal, in one study in particular. In June we implemented surgery criteria on a test basis on 13 procedures including tonsillectomies, appendectomies, hysterectomies, cholecystectomies, etcetera. The group that was testing this criteria wanted to know what the baseline frequency was of these surgeries prior to implementation of the criteria so they could find out whether or not the criteria had affected the level of surgery being performed. We produced information on those surgeries by hospital, physician, Region and State. This was a large project that was handled very well in batch mode.

SAS Analysis with Readmission Rates

The SAS statistical package capability is becoming more important to us. In fact in the study that I mentioned earlier, readmission rates, AUTOGRP could not produce the report, but we did use SAS to help us in our initial analysis. Now, I do not want to get into too much detail on this readmission report yet. The analysis has only begun, but before I show you how SAS was able to help us. I should explain at least how we determine our readmission rates. The rate was calculated as follows: total admissions minus unique patients divided by total admissions. Essentially what we are saying is that the numerator consists of those admissions which are the second or greater admission for a given patient. The readmission rate then is that number of second or greater admissions as a percent of the total admissions. The number of unique patients was determined by matching patients on the basis of Social Security Number and birthdate of Social Security Number and name and sex.

Q. What did it cost?

A. I cannot answer that question.

Q. Who is your processor?

A. American Health Systems in San Francisco until December 31st.

Q. Did you define the time frame?

A. This is one year and this is any diagnosis.

Q. So they could be admitted any time during that year?

A. Right. This was just the firstattempt to find out what was happening in the area of readmissions. These reports are based on patient and hospital. There are all kinds of details here that we have not been able to analyze yet, so I am not sure what we will find. As I said, we have voluminous reports and we have not been able to review them extensively, but the very first thing we wanted to check is the hypothesis that I am sure everyone is familiar with - the relationship between length of stay and readmission rates. That is where SAS came in. For the 95 hospitals, this is a plot of average length of stay against readmission rate and there is no correlation (Figure 1). SAS prints some statistics at the bottom of the scatter diagram which include the measure of correlation, but those statistics are not shown on this transparency. However, the lack of correlation is obvious.

Q. Do you include transfers?

A. We did not include transfers. Transfers were left out of the selections. I think the significance of this particular scattergram is that the hypothesis has been presented on a number of occasions that those facilities with low length of stay have high readmission rates and that is not the case here. There is one other correlation that we did attempt with SAS (Figure 2) - case mix to readmission rate - and again, no correlation. The case mix indicator used was one produced in the DRG reports.

Q. If they did not accept the DRG's, how did they accept the case mix report?

A. They do accept case mix believe it or not, probably because it is across all patients and you are not talking about a specific DRG. I cannot explain this difference in attitude except for the fact that everybody has always been so anxious for a casemix measure, that maybe they were happy to have it on any kind of basis. This particular comparison of casemix to readmission rate was just for us in analysis. We are trying to find out what is affecting our readmission rates. The next thing we are going to try, and we didn't have time to include it before I came out, is the occupancy rate against readmission rate. At just a couple of levels we have found an interesting correlation between high readmission rates and high occupancy rates.

Q. Do you have all patients?

A. These are federal patients. We do review some private patients but not many. SAS did help us in this study and others and probably will be used in further analyses.

Case Mix Report Analysis

The case mix report we were discussing was well accepted. We did not send out the documentation Yale produced. Although it was very good, we did not want to frighten anyone with formulas, so one of our analysts wrote a very simple but very thorough explanation of all the indices. This explanation was taken to the regions by a representative of the data department who presented the report. The hospitals then received the report and some have already contacted us. Ths hospital's response varies quite a bit from simple questions like "what are our high frequency diagnoses and length of stay" to very specific requests where they actually list physicians' license numbers and say "give us the length of stay and diagnoses for each of these physicians." So it is obvious that some hospitals have very definite ideas about what is going on and others are a little unsure.

Multivariable Profile Analysis

Now I would like to discuss what we think is really the most significant outcome from this last year with AUTOGRP. The Colorado Foundation has had a type of profile for about four years that we really liked and we thought was going to be the most useful way to display the data and show patterns of care. That profile is based on the premise of comparing a subject, say a hospital in this case, to a group of similar hospitals, with respect to their central tendency. We wanted to measure their central tendency by the 25th and 75th percentile, graph that and then graph the value of the individual subject hospital against that range over a variety of variables. We have done this manually on several occasions but it is a huge task to calculate those percentiles and do the graphs manually. These manual profiles could only be produced for a special study. We wanted to generate these profiles on all hospitals in an automated fashion so that they could be produced regularly and used as a monitoring tool.

Around the first of September, all of you in the project received some documentation entitled "Interactive Multivariable Profile Analysis." I want to show you how we have used that capability to produce the CFMC hospital profile. First of all I will show you a summary sheet that accompanies each profile (Figure 3). Since this approach is based upon comparing a subject to its peer group, we first must decide what those peer groups will be. In our state with 83 acute care hospitals, we determined a number of variables which would group hospitals. These characteristics on the left, beds, total admissions, both private and federal, percent Medicare discharges, percent Medicaid discharges, percent occupancy, the number of available services like surgery and primary care, and the case mix index, are the selected variables. Five groups of hospitals resulted. Admittedly some of the limits of those groups are a bit arbitrary but then most grouping systems are. We think they are pretty good. We are open to suggestions, and when these get out to the hospitals, undoubtedly those who look bad are going to say "you put me in the wrong group." If they have good reasons for saying why they are grouped incorrectly, then we would certainly reconsider our grouping. This type of a summary will go with every profile so that the hospital has an idea of how they fall into a range. The range of values in the second column gives the minimum and the maximum values for the variable across all the hospitals in this group. This happens to be a group consisting of 14 hospitals. For example with respect to bedsize, the range is from a minimum of 105 and to a maximum of 244 and the subject in this profile has 198 beds. The subject hospital's case mix index also would indicate that it is very close to the state's overall case mix.

There are two limitations that we have experienced so far with the COMPARE command, which is what Yale had developed enabling us to produce this type of profile. First, the maximum number of records is somewhere in the area of 25,000.

Q. How big is the biggest group in terms of total hospitals?

A. 22

Q. How small?

A. Seven, and the group of seven contains our largest hospitals. Therefore, we had to analyze only six months of data instead of a year because of this maximum number of 25,000 records.

The other limitation is on the output side. We have a definite process in mind for distributing these which I will go into after we have looked at the profiles. Because our distribution process is by hospital and the COMPARE command does not produce the entire profile by hospital, we had to do a lot of cutting and pasting.

This output corresponds to the hospital data contained in the summary sheet just presented (Figure 4). We produced the hospital profiles by pay source, so each of the 83 hospitals actually has two profiles, one for medicare and one for medicaid with the same elements on each. I will discuss the elements we used. This portion (the graph and statistics) came directly from the AUTOGRP output, and we typed on the sheet, above each graph, the description of the elements. This particular profile covers a year's period, March 1977 to March 1978. As you can see, there are 482 patients in the subject Medicaid group for that year and the total group count of the other 13 hospitals is 6743. Since many of you may not be familiar with this COMPARE command, I will briefly go over what it looks like here and what it means. Here is a bar representing the 25th to 75th percentile and here are the subject values. The scale is across the top with the scale factor listed here. The top figure uses the average length of stay and this element is the subject value, 4.64, followed by the actual values of the 25th, 50th and 75th percentiles. You can see in this case that the subject hospital is down at the low end of the range of its comparison hospitals. The next element is median length of stay for a comparison to average LOS and the last element on this page is the number of outliers. Now, in this case we define outliers as those patients who stayed more than 30 days. This sometimes gives us an idea of where to look if there appears to be a big discrepancy between these, (average and median LOS) but then our hospitals have shown all sorts of combinations in these three elements.

On the next page we have a percent of weekend admissions, that is the number of patients who were admitted on Friday or Saturday (Figure 5). In this case we have almost 25 percent of the patients coming in on Friday or Saturday. Questions concerning weekend admissions have come up before and we were not able to produce data concerning them. In this case it is really nice to have all three elements, the number of weekend admits and the average LOS of weekend admissions versus those who come in on weekdays.

Q. Do you include emergency room?

A. No, emergency room is another element later in the profile. In fact, in this profile we used all possible variables. The only things we did not look at were our own process type elements, such as the number extensions. Everything else that we collected, in one way or another, is shown in these hospital profiles. This profile we are considering now contains a variety of variables, 26 in all, and it presents a very interesting picture of the facility. Furthermore, it brings up a lot of questions. Later on I plan to discuss the process used in analyzing these, which includes going back to the terminal and AUTOGRP for more information. In this particular hospital you can see here that the average length of stay for those patients who came in on the weekend versus those who came in on the weekdays is a little over a day higher.

The next page breaks down some of the admission sources of these patients (Figure 6). We did not show all the admission sources but we showed percent admissions transferred from long term care - remember this is Medicaid now that we are considering. The percentage of admissions transferred from other acute care facilities and the percent of the admissions coming through emergency room are also given. There are 22 percent coming through the emergency room and we had about 25 percent that came in on a weekend. Very probably one of the questions we would then ask is how many of these (emergency room admissions) came in on a weekend.

The median age is the next element and for this Medicaid population in the subject hospital it is 25 (Figure 7). The percent of patients with an admission diagnosis of a symptom is also graphed here. Symptom diagnosis is being defined here as it is broken out in HICDA2. For the next element we have percent of patients with an admission diagnosis of a special condition. Again, that is the HICDA2 breakdown and that includes all kinds of things. It can be anything from an ordinary physical to cancer, chemotherapy, or surgical after care. In those cases where the value seems exceptionally high we are checking the specific diagnoses involved. We know that some hospitals specialize in certain things, such as chemotherapy, this element is easily explained. However, in others we are not sure. Then we have the percent of 1 or 2 day stays, which has been hypothesized at times to relate to these two above (symptoms and special conditions). In this case, this hospital is almost up on the 75th percentile of the group with 42.7% of their stays lasting 1 or 2 days.

The next element is percent of patients operated, and this group has a fairly high rate of surgeries - 57% (Figure 8). The element includes all procedures surgical and non-surgical. The average pre-op stay is calculated on a primary surgical procedure, again by HICDA2 terminology. In this case they are quite low with a .95 average pre-op stay. We also have percent surgical patients with multiple diagnoses. This element was added because some of our physicians felt that this had a great deal of effect on the average pre-op stay. If you had a high rate of multiple diagnoses, you would have a higher pre-op stay.

This next element is the percent of patients with two non-surgical procedures (Figure 9). These numbers are very low across the state. This is something we had never reviewed and we displayed it to see what the figures would be. There are a few hospitals in the state that stand out in this area, especially when we are talking about such low rates for everybody else. This element is a good example of one of the drawbacks of the scaling system of the compare command. You can see here that the scale is .02, in other cases it is .00035. Visually you have a range that looks extremely wide when it is not, so it is very important that the numbers are included for reference, rather than relying on the visual impact. It is a little difficult sometimes to analyze one element against the other. You cannot do it visually. You have to do it by the actual values because the scale varies. Here are the percent of patients with two surgical procedures. The subject hospital value is higher but it is still within the central tendency. The social service days element is a disappointment in terms of the numbers. The hospital in this particular profile is in a region where no problem with long term care beds exists. But, other regions in the state, who have complained a great deal about long term care days, did not appear to have a problem in their profiles and the only thing we can assume is that social service days were not recorded properly. It is really unfortunate because we know that the problem exists, particularly in some of our more outlying areas. As I have said, this hospital is in a region where they do not have much of a problem.

We also show percent of transfers to acute care facility (Figure 10). We are trying to show the same categories of discharge status as we did with admission source, with the addition of this element, the percentage of discharges against medical advice. The values for this element were extremely small and we will probably delete it from future profiles. Of course mortality rate is an important variable and for this hospital it is within the range and fairly low. The whole range is low in this group.

Q. Are you showing this to physicians and hospitals yet?

A. We are in that process. We are performing the internal staff analysis which has included physicians. We also have shown it to several physician committees and other committees which include hospital administrators. Each hospital has not yet received their own profile, but they will be receiving it in the near future.

Q. How will the hospitals accept this, won't there be some confusion?

A. As far as physicians are concerned, especially those who are closely related to the Foundation, we have been talking about this concept for four years, so they are not having problems relating to it. The hospitals will at first, and these profiles will be personally presented to each institution. Once they are used to the graphic presentation and terminology there will be no problem. Those who have reviewed the profiles accept them quite well. There will be an accompanying memorandum which explains the graph, how it is calculated, and what to look for, so there will be a great deal of documentation besides the verbal presentation.

I think the visual impact of the graph is easily understandable. It is bothersome that some of the scales are as small as they are. The original idea of the profiles depended upon a visual display along with background data, but the major information would come from the comparison of the subject to the graph.

Q. How will you use this for bringing about changes? Do you set goals with the hospitals for change, make value judgements, or ask them to make value judgements?

A. There is a whole process based on a documented protocol which is approved by our Board. I have a flow chart of that process which I'll go through when we finish looking at the graphs. We have some very definite ideas about how we are going to use these profiles.

Here is the last page of the medicaid profile (Figure 11). It shows the percent of patients who were discharged with multiple diagnoses. This theoretically is related to the complexity of the case mix. The data does depend somewhat on the coder, but then all data does. Here is a percent of patients with a symptom diagnosis as the primary discharge diagnosis. Previously, we had the percent of patients who were admitted with a symptom diagnosis. In this case the hospital had a low rate admitted, about 15 percent, and then a drop to 9.8 percent discharged with a symptom. In some hospitals the two rates are almost exactly the same. The latter circumstance is an example of an area to investigate. The percent of patients with a "Y" code primary discharge diagnosis, would be expected to be similar to the percent admitted. For example, a patient who is admitted for the removal of a pin will be discharged with that same code.

Rather than take you through the Medicare profile on this particular hospital let me show you a summary sheet which gives the overall picture of where this hospital falls in both pay sources (Figure 12). These two columns represent those elements greater than the 75th percentile for Medicaid and Medicare, and those elements less than the 75th percentile for Medicaid and Medicare. This particular hospital has some percentiles that we might question, but it is, in general, a hospital with a good reputation and one which usually looks good in the studies that we have done in the past. Also, knowing where they are located, what kind of population that they serve, et cetera, can explain some of the areas where they do fall outside the central tendency. This summary has been included to assist in the overall review of a lengthy (16 page) profile. Our next profiles will not include detailed data element descriptions and that should reduce the number of pages to four per hospital. With fewer pages, it should be easier to determine the pattern of a hospital in relation to its comparison group and the extra summary sheet will not be necessary.

Q. How often do you do them?

A. We are initially going to produce them every six months. The problem with every six months is with the flow of information from the hospital back to us in terms of justifying the particular variations. A full year probably will be required before a profile could reflect any corrective action. It is entirely possible that we will either produce them intermittently on the hospital fiscal year or once a year. We have not finalized that particular decision. If we produce them on a hospital fiscal year then we can perhaps interface with the hospital rate commission and provide information that can help in their rate setting process.

Q. You have 26 variables. How much would something like that cost?

A. The production of these profiles with AUTOGRP in batch mode costs us about $15 a hospital. We think that's exceptional.

Q. How many records?

A. 130,000

Q. I have a question in terms of your approach to the hospitals. When you give this data to the hospitals, do you expect them to analyze the data and approach you with some action-related programs or do you turn around and direct your staff towards action for the hospitals?

A. There are many questions about the analysis process so why don't I just go through that with you.

After production of the profiles we get to this point, the staff analysis (Figure 13). This has already been done; we have completed it for all 83 hospitals as of this past week. This analysis staff included representatives of the data department, the review program and their physicians, our physician consultant and the regional manager of each region we were reviewing at the time. We sat down and went through these with a fine tooth comb discussing why the elements might look the way they do. We took the initial approach that those elements falling outside the central tendency are those that we will focus on first. Later, we are going to attempt to analyze patterns across the state, across the regions and analyze some of the central tendencies themselves. A good example would be the relationship of weekend and weekday length of stay. There are definitely all three possibilities represented: Some hospitals have exactly the same stay, weekend or weekday, some have higher weekend length of stay and some have a lower weekend length of stay. We would like to do a separate investigation on that issue alone, to see how the hospitals group into those three categories and why thy might fall that way, what the differences are.

Q. Did you look at the groups you had defined, those five groups, and after you had data to see whether in fact the groups that you had defined did hold together?

A. They looked good.

Q. Did you ever try and do it with the region as the group or would you say that the groups were much better?

A. Our regions would never make a group because, for example, our region 5 covers the entire western slope, everything west of the continental divide. There is one large hospital in that entire region. There is one other osteopathic hospital that's a little bit smaller in the same city. Those two hospitals are different, and then all the rest of the hospitals are scattered, rural-type facilities. It just would not be fair to compare a 20 bed facility in the middle of nowhere to a metropolitan hospital, so our regions are just not that kind of a breaking point. They are strictly geographical. We were worried at first that because of the regional concept the regional managers would be upset with the fact that we were comparing, for example, a hospital in Grand Junction to a hospital in Denver. But they were not. They agreed that there was just no other way to do it, and the comparisons do look good. Most of the ranges are not that wide, and they really do seem to fit together.

This was the next step in this analysis. There were many things that we did question. For example, a high rate of weekend admissions and a high rate of ER's would prompt us to return to the terminal and determine whether the same patients were involved in both rates. We are trying to keep the additional data to a minimum and to ask consistent questions. If it's pre-op stay we are investigating we ask the same things every time: for example, "What were their diagnoses and what were their operations?" We are not spending a great deal of time and money at the terminal trying to explain everything before we get any further in the process. As a result of staff analysis, a summary for each hospital will be written. That narrative will present a strictly data oriented approach. The regional manager, if he or she wishes, can add subjective input and our consulting physicians may add medical opinion.

The summary, with all the backup detail goes to this group (Professional Review Committee). Now this group is scheduled to meet the first week in January. The professional review committee (PRC) is going to include Dr. Platt, our Foundation Director, all of our department medical directors, and the regional council chairmen from each of the five regions, all of whom are physicians. We will present our summaries and we will have all the detail available if they want to look at it. The PRC will analyze only those hospitals questioned in staff analysis. They may have other questions about these hospitals but we hope to keep this to a minimum also. The PRC then will put their final approval on our analysis. They may change it, they may leave it as is, or they may add something, but it will be the PRC who formally questions a hospital as to their pattern of utilization.

Q. They ask these questions to the hospitals?

A. Right

So at this stage we have to go to page 2 of the flow chart (Figure 14). The profiles are sent to the regional office. Now if the profile looks fine and there are no questions, it will be delivered to the hospital, probably by mail with a follow-up visit by the regional manager. There will be documentation with each profile, but the regional managers have said they intend to go to every hospital so that they can personally go over it with them. They want to present the profile in a positive light, and it is felt that many of the hospitals will accept it that way - as more information than they ever thought they could find out about themselves. But, if the hospital has a question in their profile, or more than one question, the regional manager and a physician from his council are going to deliver it personally to the hospital administrator, the Chief of the medical staff, the chairman of the UR committee, and the chairman of the audit committee. We involved all these people because we wanted to be sure that the information gets to all the possible places where it is going to be useful. Some people were afraid that it would go directly to the hospital administrator and maybe the chief of staff would never hear of it. If the chief of staff got it the board might never, or the administrator would never know, so it will go to all of these people for their input. They will be asked to respond. That response will have to come back to the initial profile analysis section. This is going to be a very important part and we have a whole appeals process for hospitals who disagree with our findings.

Comments by Mr. Marcus

I think it's important to mention - you say they are going to be asked to respond. By virtue of the analysis process we have gone through both in stratifying and development of the peer group and the additional terminal special studies that we have done after we have established the pattern of care, we will have eliminated a lot of these objections and a lot of the comebacks that may in fact be presented by a hospital staff as regards to how they look different from the pattern. Their response is going to have to be developed in a very factual and meaningful way if in fact they can justify it. I fully expect that the responses will be such that there is nothing we can say that is going to justify this and we are going to have to change the way we are doing it.

Q. Is that anticipatory or have you actually gone through their files?

A. We haven't gone through them yet but by the additional information we are pulling out of the terminal to explain these patterns, by the development of the case mix index, and by the peer grouping, we have eliminated all those objections when they come back to us.

Q. Does the response go back to the regional office or to the physician's committee, or to your office?

A. Initially to the region. The responses all come to the region, and then back to all the other levels. They can come back to us, the data staff, and ask for more information and I imagine that some of them will do this.

Q. What type of follow up are you planning?

A. This is what we were talking about when we said we would produce the profiles semi-annually, so six months later we would do the same profile again and the major portion of the staff analysis at that point would be a comparison to the previous profile, particularly in those hospitals where there were questions to see if they had changed their patterns.

Q. Will that trend analysis be done manually or through AUTOGRP?

A. Through the data processing system mostly but a little bit of both I imagine.

Q. Is there a reason why you chose to do all the hospitals at once, rather than stagger them? I am thinking about this committee that's loaded down - it's got to be a marathon.

A. That's why the professional review committee will not look at all hospitals. They will look at the ones that the staff has screened. That is the purpose of the intermediate analysis. They could review all profiles if they wanted, but I do not think they are going to have that much stamina.

Q. How many did you screen out?

A. I cannot tell you totally how many we screened out because we have not finished all the intermediate portion of supplemental information. A rough guess right now is that we would be screening out totally less than half of the hospitals. There are some that will have minimal questions and then there will be a small portion that have some very major questions. In all these staff analyses with the regional managers, everyone without exception said there were no surprises. They knew these hospitals and that this was the first time that they ever had anything to prove what they know. They were very impressed. In fact, most of the Foundation staff was extremely impressed with this type of a presentation. They were thrilled to have it. The reaction of those outside the process, physicians who perhaps are not so sympathetic to PSRO or hospital administrators, has really ranged. The hospital administrators had varied reactions to it, also. Some of them were quite uncomfortable with it. It just really worried them.

Q. Obviously this hospital profile process brings up a lot of problems and it seems to be in concurrent review that whatever we are doing is a problem-solving tool, are you thinking about modifying the review system in those hospitals?

A. Yes, this will definitely be used for that purpose. There will be some hospitals as a result of this first analysis that will go on to some type of specialized concurrent review. Pre-admission review is a possibility in some cases and the abstract that we are implementing January 1st will have ample space for that. Some of the elements seen in this profile will be deleted from future ones because they were not useful. I am sure we will add others because there will be new elements in our abstract as of January 1. Essentially we will produce the same profile on a regular basis and use the comparison. Those that are screened out and have problems will be focused on.

Q. How long does it take for this process from beginning to end?

A. Well, this approach will be a primary profiling tool and we are going to make it more efficient. This first attempt is educational and takes less time than you think. This type of a presentation is very easy to go through and we averaged about four hours per region, which I do not consider unreasonable. We were able to finish the first part of the staff analysis in less than a week and then the supplemental information could probably be obtained in say three or four days working at the terminal.

Q. How big is your data staff?

A. We have four analysts.

Q. Plus a manager?

A. Four analysts and a manager for the data analysis side.

This same approach is going to be used for physician profiles also, and we are just starting that. In fact, we ran a prototype for this meeting, but because of the snow storm, the office was closed and it was not xeroxed and typed.

Q. You do have a prototype though? How many elements in it?

A. There are 27. The physician profile will consist of two portions - it will have a descriptive portion that will come from the terminal and it will contain things like displays of their patients by case or age and some search-order-report type displays showing what a given physician's individual case mix is. Then, we hope to group the physicians, probably by specialty, and those physicians who have a sufficient number of cases (there will be some minimum) will be profiled against their peers in the same way as the hospitals have been with the CARET/stick type approach. Interest in the physician profiles should be as great, if not greater, than in the hospital profiles.

Comment by Mr. Marcus:

We do have a non-federal population which we plan to analyze in the same manner. In combination with a long-term care demonstration project, we will be getting close to 200,000 abstracts each year. We will be able to perform the same type of analysis on them. We are quite pleased. Rather than focusing in on a particular subject, we have established a hospital type of pattern which can be either explained away by using the terminal or if unexplained, sent back to the hospital. At $15 a hospital profile, its cost effectiveness is just unbelievable. My final comment to the Yale staff is that it cost us more to cut and paste than it did to run the profile. There must be some way of getting around that.

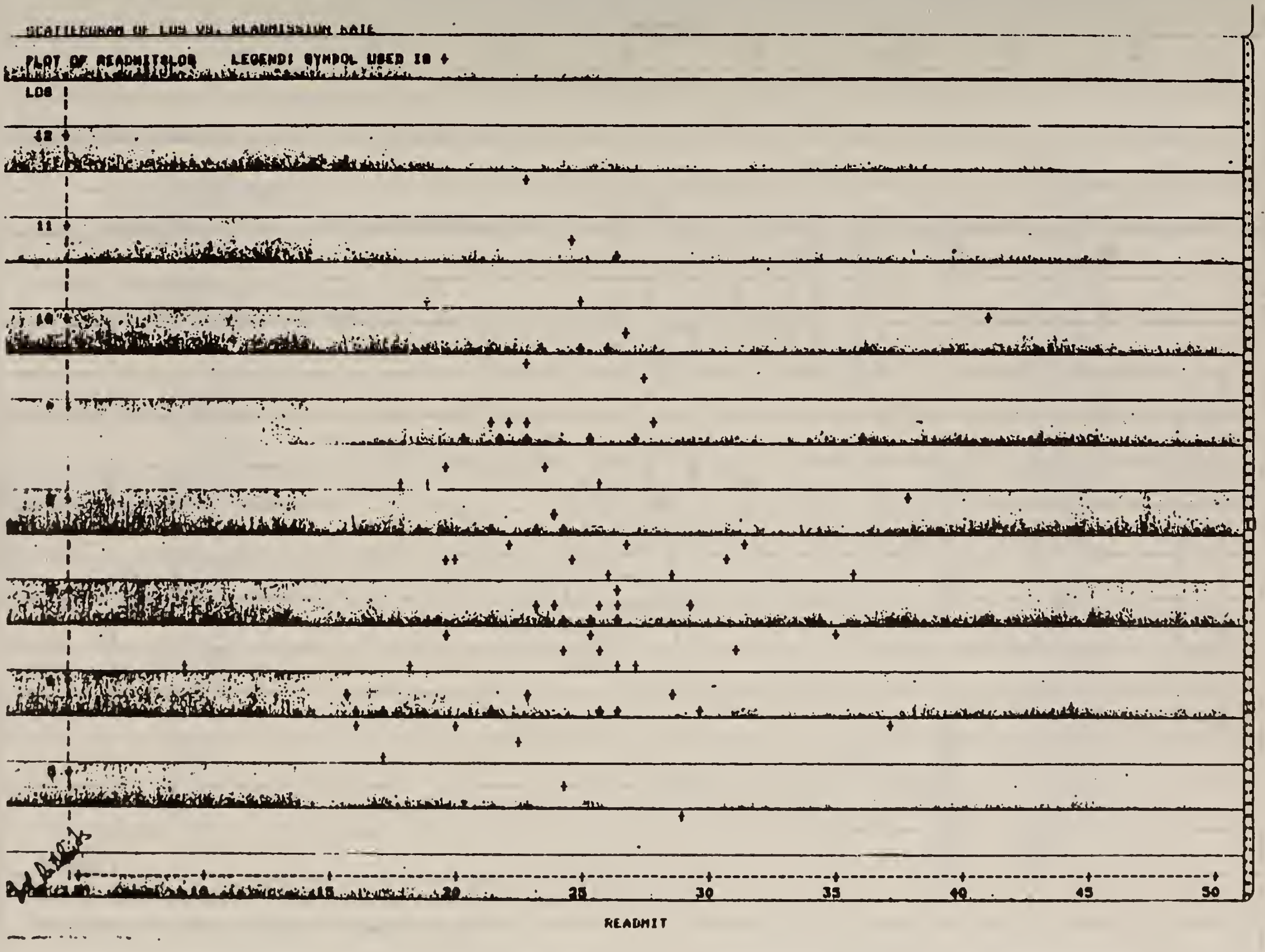
SCATTERGRAM OF LOS VS. READMISSION RATE
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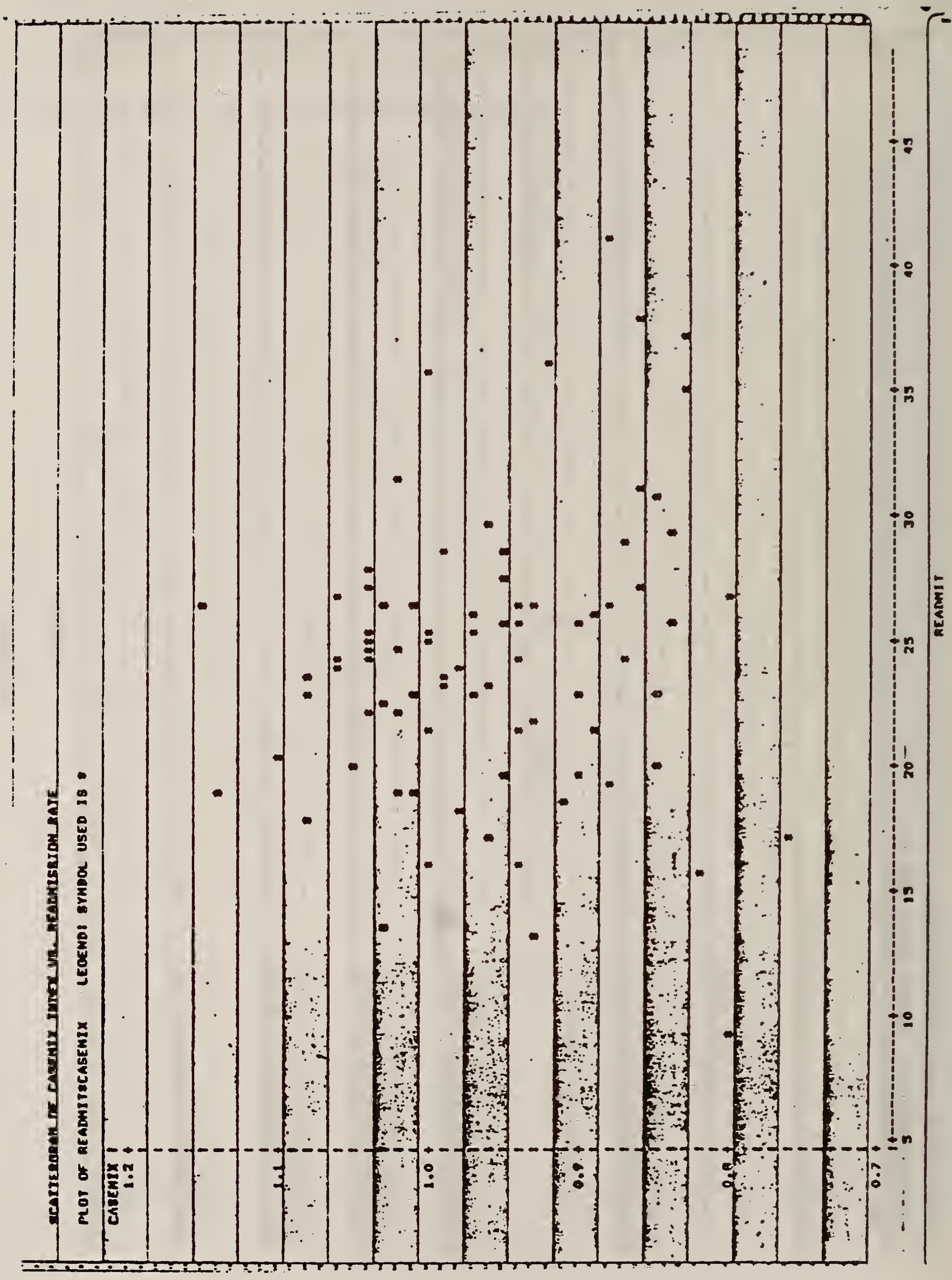
Figure 1


SCATTERGRAM OF CASEMIX INDEX VS. READMISSION RATE
PLOT OF READMIT*CASEMIX LEGEND: SYMBOL USED IS *
CASEMIX
1.2
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5
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15
20
25
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35
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45
READMIT

Figure 2

COLORADO FOUNDATION FOR MEDICAL CARE

Health Care Data Analysis

This comparison group consists of 14 hospitals which have been tratified on the basis of the variables listed below. The group's minimum and maximum of each variable are listed under the column Range of Values and the profile subject's value is shown under Subject Hospital.

Variable	Range of Values	Subject Hospital
Beds[1]	105-244	198
Total Admissions[1] (Private & Federal)	3316-10451	10451
Percent Medicare[2] Discharges	10.6-37.1	21.5
Percent Medicaid[2] Discharges	3.2-13.6	4.4
Percent Occupancy[1]	37.7-78.9	69.7
Available Services[1]	13-26	22
Casemix Index[3]	.757-1.059	1.059

---

1. 1977 American Hospital Association (AHA) Guide
2. 1977 Colorado Admissions Program (CAP) data on Federal patients
3. Developed by Yale University Center for Health Studies using 1977 CAP data. A value 1.0 represents the complexity of the entire state's casemix.

Figure 3

MEDICAID
March 1977 - March 1978

```
          PROFILE ELEMENTS:
PROFILE SUBJECT: HOSP       SUBJECT COUNT= 482 GROUP COUNT= 6743
```

1. <u>Average LOS</u> - The total number of a hospital's patient days of stay divided by the total number of discharges from that hospital for this paysource.

```
            4.00      5.00      6.00      7.00      BY= .1
LOS        |+---------+---------+---------+---------|  AVERAGE    25TH    50TH    75TH
               V                                        4.64
              ===============                                   4.41    5.26    5.77
```

2. <u>Median LOS</u> - The 50th percentile of a hospital's distribution of length of stay for this paysource.

```
            2.75      3.25      3.75      4.25      BY= .05
LOS        |+---------+---------+---------+---------|  MEDIAN     25TH    50TH    75TH
               V                                         3.00
               =====================                            3.00    3.50    4.00
```

3. <u>Percent of Outliers</u> - The hospital's number of patients who stayed longer then 30 days divided by the total number of discharges from that hospital for this paysource.

```
             .24       .59       .94      1.29      BY= .035
OUTLIERS    |+---------+---------+---------+---------|    RATE    25TH    50TH    75TH
                        V                                  .62
               ============================                      .39     .74    1.32
```

Figure 4

```
          4.  Percent of Weekend Admissions - The number of a hospital's admissions
              that occurred on a Friday or Saturday divided by the total number of the
              hospital's patients within this paysource.

            17.8        19.9        21.8        23.8        BY=  .2
WKENDADM   |+-----------+-----------+-----------+-----------|    RATE      25TH      50TH      75TH
                 ========================         V              24.69
                                                                          19.66     21.24     23.25

PROFILE SUBJECT: HOSP          SUBJECT COUNT= 119 GROUP COUNT= 1408
         5.  Average LOS of Weekend Admissions - The total number of a hospital's
             patient days for Friday and Saturday admissions divided by the total
             number of patients admitted on Friday or Saturday for this paysource.

           4.00        5.00        6.00        7.00        BY=  .1
LOS       |+-----------+-----------+-----------+-----------|   AVERAGE     25TH      50TH      75TH
                       V                                         5.55
                ======================                                    4.43      5.62      6.50

PROFILE SUBJECT: HOSP          SUBJECT COUNT= 363 GROUP COUNT= 5335
        6.  Average LOS of Weekday Admissions - The total number of a hospital's
            patient  days for  admissions occurring Sunday through Thursday divided
            by that hospital's total number of patients within this paysource that
            were admitted on any of those days.

          4.10        4.60        5.10        5.60        BY=  .05
LOS      |+-----------+-----------+-----------+-----------|   AVERAGE     25TH      50TH      75TH
               V                                                4.34
                 ======================                                  4.43      5.05      5.49
```

Figure 5

```
PROFILE SUBJECT: HOSP        SUBJECT COUNT= 482 GROUP COUNT= 6743
```

7. Percent Admissions Transferred from LTC - The number of a hospital's admissions which were transfers from a Long Term Care facility divided by the total patients at that hospital within this paysource.

```
             .0        1.5        3.0        4.5       BY= .15
             |+---------+----------+----------+---------|    RATE    25TH    50TH    75TH
ADMITLTC                                     V                4.15
                ==============                                        .64    1.20    2.48
```

8. Percent Admissions Transferred from Acute Care Facility - The number of a hospital's admissions which were transfers from another acute care facility divided by the total patients at that hospital for this paysource.

```
             .10       .35        .60        .85       BY= .025
             |+---------+----------+----------+---------|    RATE    25TH    50TH    75TH
ADMITACT                 V                                     .41
                ===============================                       .22     .44     .95
```

9. Percent Admissions from Emergency Room - The number of a hospital's admissions from its emergency room divided by the total patients at that hospital for this paysource.

```
             11.0      21.0       31.0       41.0      BY= 1
             |+---------+----------+----------+---------|    RATE    25TH    50TH    75TH
ADMITER                 V                                    22.82
                =================                                    15.50   26.90   32.17
```

Figure 6

10. Median Age - The 50th percentile of a hospital's distribution of patient age for patients within this paysource.

```
            21.3         22.8         24.3         25.8        HY=  .15
AGE        |+------------+------------+------------+-----------|    MEDIAN     25TH     50TH     75TH
                                       V                             25.00
              ========================                                        22.00    24.00    25.50
```

11. Percent Patients With an Adx of a Symptom - The number of admissions in a hospital whose admit diagnosis fell into the H-ICDA II ranges of 770.0 to 796.9 (Signs, Symptoms, and Ill-defined Conditions) divided by the hospital's total patients for this paysource.

```
            14.0         16.5         19.0         21.5        HY=  .25
ADMSYMP    |+------------+------------+------------+-----------|     RATE      25TH     50TH     75TH
              V                                                      15.15
              ============================                                    15.24    17.40    22.02
```

12. Percent Patients With an Adx of a Special Condition - The number of admissions in a hospital whose admit diagnosis was in the range of H-ICDA II codes Y00.0 to Y86.9 (Special Admissions and Examinations without complaint or reported diagnosis) divided by the hospital's total patients for this paysource.

```
            1.9          3.4          4.9          6.4         HY=  .15
YCODEADM   |+------------+------------+------------+-----------|     RATE      25TH     50TH     75TH
                                       V                              5.81
              ===================                                              2.65     4.24     5.42
```

13. Percent of 1 or 2 Day Stays - The number of a hospital's discharges who stayed less than 3 days divided by that hospital's total discharges within this paysource.

```
            25.0         35.0         45.0         55.0        HY=
SHORTSTY   |+------------+------------+------------+-----------|     RATE      25TH     50TH     75TH
                                 V                                   42.74
              ===============                                                 29.20    31.75    42.96
```

Figure 7

14. **Percent Patients Operated** - The number of a hospital's discharges who underwent at least one procedure divided by that hospital's total discharges within this paysource.

```
SURGCASE      |36.0       47.0       56.0       66.0       BY= 1
              |+----------+----------+----------+----------|   RATE      25TH      50TH      75TH
                          V                                    51.66
                 ==================                                      41.69     48.02     58.46
```

```
PROFILE SUBJECT: HOSP          SUBJECT COUNT= 219 GROUP COUNT= 2806
```

15. **Average Preop Stay** - A hospital's total number of patient days prior to the primary surgical procedure (H-ICDA II codes 01.0 to 90.9) divided by the number of patients for this paysource that underwent at least one surgical procedure.

```
PREOP         |.82        1.07       1.32       1.57       BY= .025
              |+----------+----------+----------+----------|  AVERAGE    25TH      50TH      75TH
                  V                                            .95
                         =====================r                          1.06      1.20      1.59
```

16. **Percent Surgical Patients with Multiple Diagnoses** - A hospital's total number of patients with a primary surgical procedure and multiple discharge diagnoses divided by the total number of surgical patients for this paysource.

```
SURG2DX       |17.0       27.0       37.0       47.0       BY= 1
              |+----------+----------+----------+----------|   RATE      25TH      50TH      75TH
                                     V                         36.53
                 ==================                                      21.32     28.19     37.18
```

Figure 8

PROFILE SUBJECT: [illegible] COUNT= 412 [illegible] COUNT= 674

17. Percent of Patients with 2 Non-Surgical Procedures - The number of a hospital's patients who underwent 2 diagnostic or non-surgical procedures (H-ICDA II codes 91.0 to 99.9) divided by the hospital's total patients for this paysource.

```
            -.06        .14         .34         .54         BY=  .02
           |+----------+----------+----------+----------|      RATE      25TH      50TH      75TH
TWOPPROC                  V                                     .21
               ==============================                            .00       .35       .58
```

18. Percent of Patients with 2 Surgical Procedures - The number of a hospital's patients who underwent 2 surgical procedures (H-ICDA II codes 01.0 to 90.9) divided by the hospital's total patients within this paysource.

```
            4.0         9.0         14.0        19.0        BY=  .5
           |+----------+----------+----------+----------|      RATE      25TH      50TH      75TH
TWOSURG                            V                           14.11
                 =====================                                   6.51      9.10      16.51
```

19. Percent of Social Service Days - The total number of a hospital's extension days used for a social service reason divided by the total number of patient days for this paysource in that hospital.

```
            .0000       .0035       .0070       .0105       BY=  .00035
           |+----------+----------+----------+----------|      RATIO     25TH      50TH      75TH
SSDAY          V                                                .00
/LOS             ============================                            .00       .00       .01
```

20. Percent of Transfers to LTC - The total number of a hospital's discharges who were transferred to a Long Term Care facility (skilled or intermediate) divided by the hospital's total number of discharges within this paysource.

```
            .60         1.60        2.60        3.60        BY=  .1
           |+----------+----------+----------+----------|      RATE      25TH      50TH      75TH
TRANSLTC                                         V             4.15
                 ============================                            1.09      1.87      3.79
```

Figure 9

21. <u>Percent of Transfers to Acute Care Facility</u> - The total number of a hospital's discharges who were transferred to another acute care facility divided by the hospital's total number of discharges for this paysource.

```
                  .59         .94        1.29        BY=  .035
             .24                                           RATE       25TH       50TH       75TH
           |+---------+----------+----------+----------|   1.04
TRANSACT                          V                                    .40        .87       1.39
                ==============================
```

22. <u>Percent of Discharges Against Medical Advice</u> - The total number of a hospital's discharges who left without physician's approval divided by the hospital's total number of discharges for this paysource.

```
                   .35         .60         .85         BY=  .025
             .10                                            RATE       25TH       50TH       75TH
           |+---------+----------+----------+----------|     .41
AMA                    V                                              .21        .62        .93
                ==============================
```

23. <u>Mortality Rate</u> - The total number of a hospital's patients who died divided by the hospital's total discharges within this paysource.

```
                  .55        1.05        1.55          BY=  .05
             .05                                            RATE       25TH       50TH       75TH
           |+---------+----------+----------+----------|     .83
DEATH                  V                                              .25        .81       1.33
                =======================
```

Figure 10

24. **Percent Patients with Multiple DX** - The total number of a hospital's patients who had more than one discharge diagnosis divided by the total number of patients for this paysource.

```
            26.0      31.0      36.0      41.0      BY= .5
            |+---------+---------+---------+---------|    RATE     25TH    50TH    75TH
MULTDX                           V                        36.72
              ===========================                          28.13   35.02   41.29
```

25. **Percent Patients with a Symptom Code DX1** - The number of a hospital's discharges whose primary discharge diagnosis was a symptom code in the H-ICDA II range of 770.0 to 796.9 divided by the total number of discharges for this paysource.

```
            9.0       10.5      12.0      13.5      BY= .15
            |+---------+---------+---------+---------|    RATE     25TH    50TH    75TH
SYMPDX        V                                           9.75
              ======================                               9.72    11.70   13.02
```

26. **Percent Patients with a "Y" Code DX1** - The number of a hospital's discharges whose primary discharge diagnosis was a "Y" code in the H-ICDA II range of Y00.0 to Y86.9 divided by the total number of discharges for this paysource.

```
            .9        2.4       3.9       5.4       BY= .15
            |+---------+---------+---------+---------|    RATE     25TH    50TH    75TH
YCODEDX                                    V              5.39
              ========================                             1.61    3.03    5.27
```

Figure 11

Health Care Data Analysis

Profile Summary Report

Element	Elements Greater than 75th Percentile		Elements Less than 25th Percentile	
	Medicaid	Medicare	Medicaid	Medicare
1. Average LOS				▨
2. Median LOS				
3. Percent of Outliers				▨
4. Percent of Weekend Admissions	▨			
5. Average LOS of Weekend Admissions				▨
6. Average LOS of Weekday Admissions			▨	
7. Percent Admissions Transferred from LTC	▨	▨		
8. Percent Admissions Transferred from Acute Care Facility				
9. Percent Admissions from Emergency Room				▨
10. Median Age				
11. Percent Patients With an Adx of a Symptom			▨	
12. Percent Patients With an Adx of a Special Condition	▨			
13. Percent of 1 or 2 Day Stays		▨		
14. Percent Patients Operated				
15. Average Preop Stay			▨	▨
16. Percent Surgical Patients with Multiple Diagnoses				
17. Percent of Patients with 2 Non-Surgical Procedures				
18. Percent of Patients with 2 Surgical Procedures		▨		
19. Percent of Social Service Days			▨	▨
20. Percent of Transfers to LTC	▨	▨		
21. Percent of Transfers to Acute Care Facility				
22. Percent of Discharges Against Medical Advice				▨
23. Mortality Rate				
24. Percent Patients with Multiple DX				
25. Percent Patients with a Symptom Code DX1				
26. Percent Patients with a "Y" Code DX1	▨			

Figure 12

COLORADO FOUNDATION FOR MEDICAL CARE

Hospital Profile Decision Flow

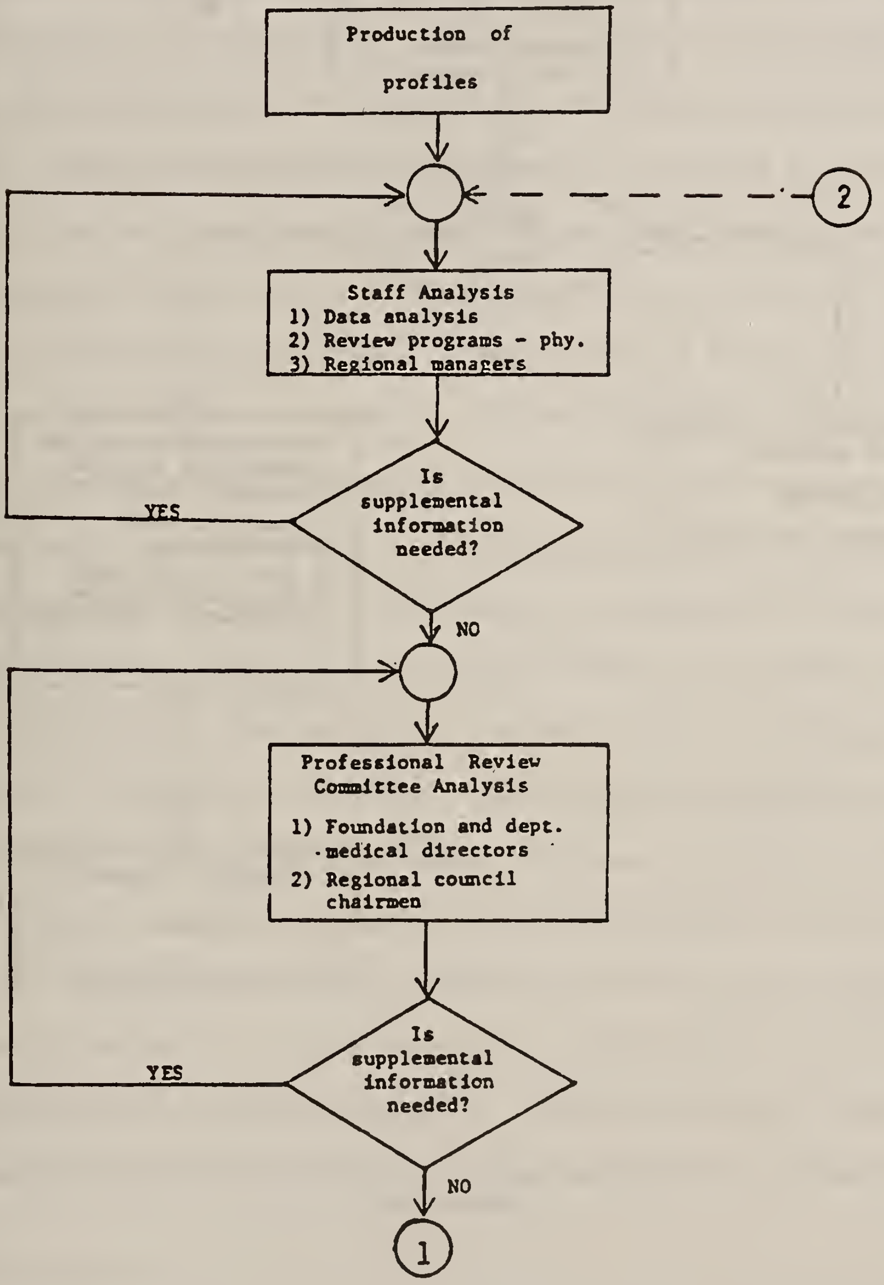

Production of profiles
2
Staff Analysis
1) Data analysis
2) Review programs - phy.
3) Regional managers
Is supplemental information needed?
YES
NO
Professional Review Committee Analysis
1) Foundation and dept. medical directors
2) Regional council chairmen
Is supplemental information needed?
YES
NO
1

Figure 13

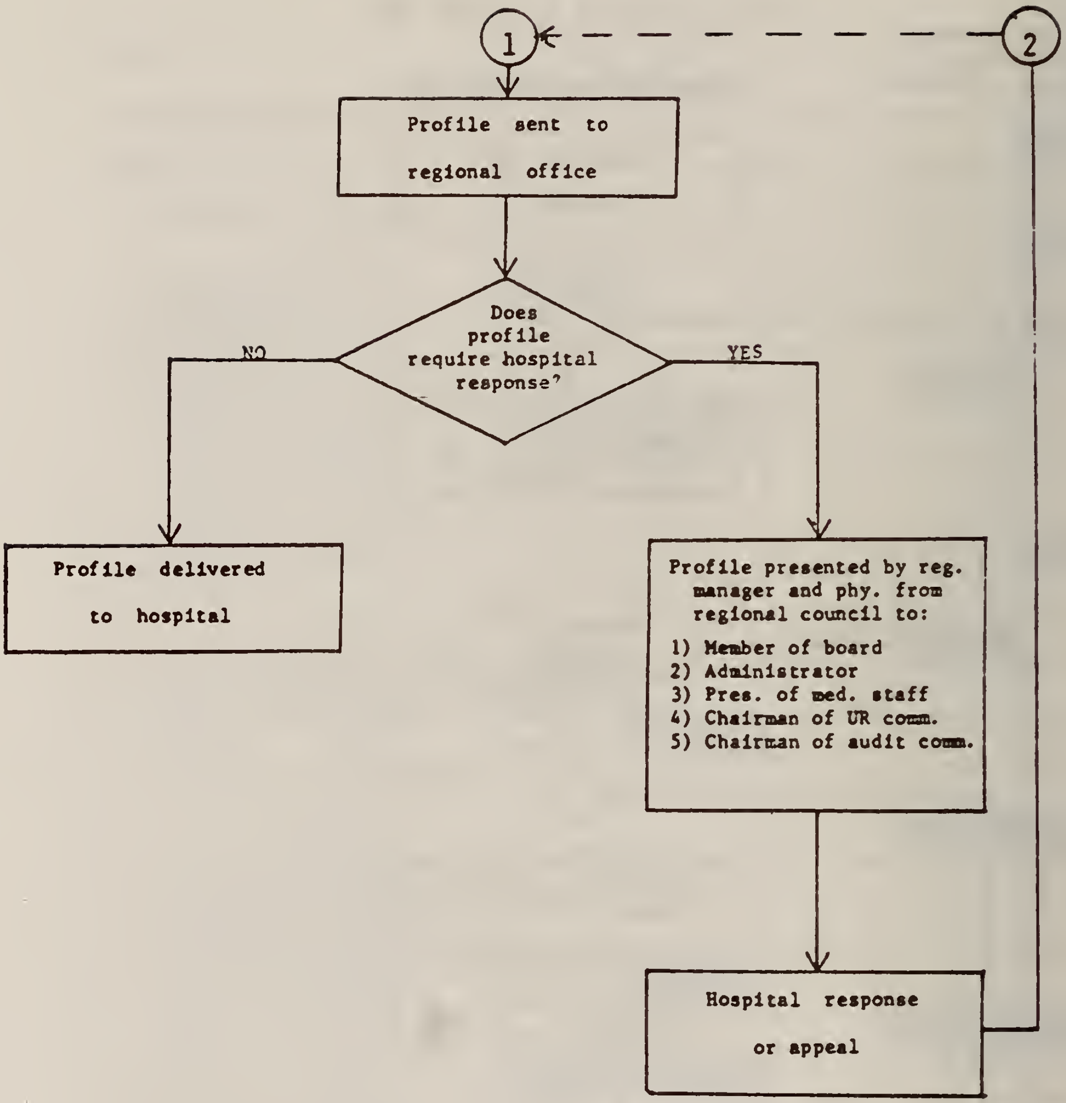

1
2
Profile sent to regional office
Does profile require hospital response?
NO
YES
Profile delivered to hospital
Profile presented by reg. manager and phy. from regional council to:
1) Member of board
2) Administrator
3) Pres. of med. staff
4) Chairman of UR comm.
5) Chairman of audit comm.
Hospital response or appeal

Figure 14

DADE-MONROE PROFESSIONAL STANDARDS REVIEW ORGANIZATION*

Lois Gaffney

The most frequent DRG in our region is DRG 110 - Disease of the Eye with Lens Extraction. Approximately three percent of the observations in this DRG were bilateral lens extraction. For the purpose of this analysis, we decided to deal with single lens extractions and bilateral lens extractions separately. Single lens extraction patients were displayed by hospital by frequency to see how those hospitals treating a significant percentage of the patients compared to the total area regarding length of stay (LOS) (Figure 1). A profile of all hospitals revealed the mean length of stay in the area to be 3.59 (Figure 2).. Two hospitals - D and F - showed significant deviation in mean LOS from the area as a whole and were isolated for further analysis.

When statistics were presented by admitting physicians from Hospital F, it was revealed that 61% of the cases belonged to Physician 10 (Figure 3). These patients had an average length of stay (ALOS) of 5.49 days. After three patients with unusually long LOS's were removed to make the statistics more representative, the mean was 4.93 days. The hospital showed a mean LOS of 3.90 days without Physician 10's patients. The same procedure was done for Hospital D (Figure 4), which revealed 57% of the patients were treated by Physician 20. These patients had a mean LOS of 5.84 and when unrepresentative outliers were eliminated, the mean was 5.21. The hospital had a mean LOS of 3.91 excluding Physician 20's patients. Thirteen percent of Hospital D's patients were treated by Physician 21. These patients had a mean LOS of

---

* The information reported here is based on Ms. Gaffney's presentation at the User's Forum as well as on supplemental material submitted to us at a later date.

6.00 and, when outliers were eliminated, the mean was 4.75. Therefore, it appeared that these three physicians in these two hospitals were keeping their single lens extraction patients approximately five days while the area as a whole showed a mean LOS of 3.59 days for single lens extractions.

We presented specific profiles to the two hospitals in question during September 1978 during a personal visit. We were assured that remedial action would be taken. To evaluate the impact of the hospitals' actions as quickly as possible, a manual calculation was prepared using October and November abstracts. Figure 5 illustrates the results of this manual screening. As you can see, Physician 10 in Hospital F has gone from a 5.49 ALOS to a 3.78 ALOS. Likewise, physician 20 and 21 in hospital D have greatly decreased their ALOS.

Update: A computer reprofile covering 4th quarter 1978 data was recently performed to further evaluate impact and definite improvement was once again demonstrated (Figure 6). As a result of this profile, we have been able to "focus out" all concurrent review of cataract patients in our community with the exception of these three physicians. If they continue to maintain an acceptable ALOS for two more quarters in 1979, we will focus them out as well.

Bilateral lens extractions were considered next. Out of 2,417 lens extraction patients, only 62 (3%) were bilateral. These 62 cases were displayed by hospital (Figure 7). This revealed a vast discrepancy between the two hospitals with the greatest number of cases regarding mean LOS. A profile of all hospitals showed a 2-11 day range for bilateral lens extractions (Figure 8). The two hospitals with the greatest number of cases, hospitals A and F, were then isolated for further study. This revealed hospital A having bilateral lens extraction patients spread out over many staff members (Figure 9), but 73% of the patients in hospital F were treated by Physician 10 (Figure 10). Hospital A shows a mean LOS of 3.08 days while Hospital F shows 11.07 days.

Hospital F was informed of this matter in the same report, previously mentioned, and did agree to discuss the matter with the physician involved. We have not conducted a reprofile as yet, but will do so in the near future to determine if the percent of bilateral cataracts for Physician 10 has decreased. If not, we will request a chart review to try to determine the appropriateness of indications.

Turp Profile

A profile to evaluate LOS for patients who received a TUR of the prostate was undertaken as a result of national statistics presented to us by HSQB showing an extended LOS in this community. Unfortunately, we had only 241 observations among 40 hospitals, therefore patterns were difficult to identify.

All hospitals with 10 or more observations were evaluated for ALOS, pre-op LOS, post-op LOS and between-op LOS (Figure 11). All eight hospitals were found to have an ALOS above the national and regional norms. Six (6) of the eight hospitals with high LOS were presented with a full hospital profile which included physician profiles, as illustrated in Figure 12. These six hospitals were requested to review the data and respond with their findings. The general findings from most hospitals was the fact that most patients warranted an extended LOS based on secondary diagnosis which, unfortunately, were not recorded in our data base.* This finding reflects directly on the quality and accuracy of the data being submitted by our hospitals.

A recent restudy was performed on 4th quarter 1978 data indicating a consistent decrease in LOS as a result of our profiling efforts. Figure illustrates a hospital by hospital comparison.

Technical Problems: In performing the profile, we ran across several problems worthy of comment.

(1) We had a great deal of difficulty explaining to the physicians in our community exactly why retropubic prostatectomies were included with transurethral prostatectomies in the same DRG. The entire DRG concept was questioned repeatedly.

(2) In many cases (40 out of 241 observations) the primary procedure (TUR) was not placed in the appropriate order. There is a tendency to list procedures in chronological order rather than order of importance. Definite patterns of hospital were identified and actions taken.

Summary

In conclusion, several important things were learned from this profile, aside from an analysis and reduction of LOS. They are as follows:

(1) Correct ordering of procedures is extremely important to accurate DRG assignments.

(2) The accuracy of our data in terms of appropriate ordering of procedures warrants further action.

(3) Secondary diagnoses are not always listed on our abstracts thereby inaccurately reflecting the patients condition and associated LOS. This is detrimental to the appropriate assignment of DRG's.

---

*Since only TUR patients without secondary diagnosis were to be included in this profile, this was a significant finding.

(4) The more specific the information we submit to the hospital, the better the results. Physician profiles, pre and post-op LOS, etc. are extremely beneficial to the hospital.

Questions and Answers:

Q. Are you just picking the hospitals who are above the norm?

A. I think we are going to do maybe more than that to get the whole community LOS down. It may mean an MCE study or it may mean some kind of special study to learn what is different about our patients. There may be some pattern that we can identify that will help the physicians to understand why they are so much longer.

DRG Study

We did one other thing, more for public relations, because we had not given back the hospitals any information and they had been giving us data for a year and a half. It was really getting to the point of what are you doing over there, so we grouped our hospitals by bed size and generated the top ten DRGs for each group. It was basically a display that showed them where they were in relation to other hospitals of like size for DRGs. We had a problem in that we used DRGs, which was a hassle because some of them were the ones in which 20 different diagnoses or symptoms were grouped together. However, we had no problems with the DRGs that are very clear cut. We thought that was good because it got them used to the idea of profiles and DRGs, and it was helpful in that respect.

Comment: Robert Fetter

I would like to say a couple of words about DRGs. They should not be viewed as more than a start especially in some areas. Generally the areas in which they are somewhat fuzzy the practice of medicine is fuzzy. The labeling of patients is controversial. There is no possible way to develop consistent medically homogeneous classes when you are talking about cerebral vascular accidents because they can't even agree on a label, so you are stuck with sometimes a relatively imprecise classification. In this case, for example, the case you are talking about, when we look at data from a large number of sources and test the hypothesis that there is a difference due to the different kind of procedure we get no confirmation of that. That is not to say that it may not be confirmed in some areas. If somebody objects to a DRG on the grounds of definition, then break it down an alternative way and look at the differences. If the differences are real and in fact significant, then use it that way, or split it further if there is a valid clinical reason and you then get confirmation statistically. If you should use it that way, then let us know so that we can consider that in the next round. We expect to develop a new set of DRGs based on ICD-9 as soon as ICD-9 data becomes generally available. The DRGs should be viewed as a way of communication - as the beginning of the dialogue and not as the end. So change them if you have valid reason, one of the major purposes of AUTOGRP's ability is to take the DRG and adjust it for source of payment, adjust it for secondaries or whatever else. What we find is that once you have made all these adjustments, then you can come down to a decision.

Single Lens Extraction Patients by Hospital

```
number                     mean          s.d   HOSPITAL
 obs.      pct              LOS          LOS   code

   740   31.42%            3.17         1.31    A
   383   16.26%            3.13         1.86    B
   162    6.88%            3.25         1.75    C
   160    6.79%            5.04         2.90    D
   139    5.90%            3.47         1.52    E
   126    5.35%            5.13         3.43    F
    89    3.78%            3.94         2.52    G
    86    3.65%            4.02         2.77    H
    63    2.68%            2.92         2.25    I
    58    2.46%            2.93         1.38    J
>>
    55    2.34%            3.87         2.22    K
    43    1.83%            4.09         1.46    L
    42    1.78%            4.45         3.10    M
    38    1.61%            3.79         3.43    N
    30    1.27%            2.73         1.29    O
    28    1.19%            3.93         1.93    P
    25    1.06%            5.72        11.11    Q
```

Figure 1

Single Lens Extraction Patients by Hospital

```
HOSPITAL   0         10        20        30
          !+---------+---------+---------+---------!
   N      !  M-*                                   !     SIZE    MEAN    S.D.   MEDIAN
   O      !  M*                                    !       38    3.79    3.43     2.00
   R      !  M                                     !       30    2.73    1.29     2.00
   I      !  M*                                    !        3    2.00     .00     2.00
   S      !   M-*                                  !       63    2.92    2.25     2.00
   K      !   M*                                   !       15    3.60    1.36     3.00
   P      !   M*                                   !       55    3.87    2.22     3.00
   H      !   M*                                   !       28    3.93    1.93     3.00
   T      !  *M-*                                  !       86    4.02    2.77     3.00
   C      !   M                                    !        7    4.14    3.36     3.00
>>                                                        162    3.25    1.75     3.00
   U      !   M                                    !
   E      !   M*                                   !        7    3.14     .35     3.00
   J      !  *M                                    !      139    3.47    1.52     3.00
   V      !  *M                                    !       58    2.93    1.38     3.00
   Q      !   M*                                   !        6    3.00     .58     3.00
   B      !  *M*                                   !       25    5.72   11.11     3.00
   A      !  *M*                                   !      383    3.13    1.86     3.00
   M      !   M*                                   !      740    3.17    1.31     3.00
   W      !   *M*                                  !       42    4.45    3.10     3.50
   D      !    M-*                                 !       15    4.07    1.06     4.00
>>                                                        160    5.04    2.90     4.00
   X      !   *M                                   !
   Y      !    M-----*                             !       18    3.72     .87     4.00
   F      !    M*                                  !        4    6.00    3.46     4.00
   L      !   *M                                   !      126    5.13    3.43     4.00
   Z      !   *M                                   !       43    4.09    1.46     4.00
   AA     !   *M                                   !       10    3.90     .54     4.00
   G      !  *-M                                   !        2    4.00     .00     4.00
   BB     !    M                                   !       89    3.94    2.52     4.00
     TOTAL!  *M*                                   !        1    4.00     .00     4.00
          !+---------+---------+---------+---------!     2355    3.59    2.41     3.00
           0         10        20        30
```

Figure 2

Hospital F by Admitting Physician

Number obs.	pct.	Mean LOS	S.D LOS	ADMPHYS code
77	61.11%	5.49	3.76	10
18	14.28	4.33	3.06	11
13	10.32	3.53	.51	12
3	2.38	3.67	.47	13
3	2.38	3.00	.00	14
2	1.59	4.00	.00	15

Figure 3

Hospital D by Admitting Physician

Number obs.	pct.	Mean LOS	S.D. LOS	ADMPHYS code
91	56.88%	5.84	3.17	20
17	10.63	6.18	2.06	21
14	8.76	2.21	.42	22
12	7.50	4.00	.60	24
9	5.63	3.00	.86	25
6	3.75	2.67	1.11	23

Figure 4

HOSPITAL F

REPROFILE - PHYSICIAN 10

SINGLE LENS EXTRACTIONS:	LOS	PRE-OP	POST-OP
	3	1	2
	3	1	2
	4	2	2
	4	2	2
	5	2	3
	6	4	2
	3	1	2
	3	1	2
	3	1	2
	34	15	19
AVERAGE:	3.78	1.67	2.11

HOSPITAL D

REPROFILES - PHYSICIANS 20 & 21

	TYPE OF EXTRACTION	LOS	PRE-OP	POST-OP
PHYSICIAN 20 -	single	4	1	3
	single	4	1	3
PHYSICIAN 21 -	single	4	1	3
	bilateral	4	1	3

Figure 5

— CATARACT PROFILE UPDATE —
(with single lens extraction)

[area ALOS = 3.59]

HOSPITAL F:

Physician 10:

Before Interaction:

Count	Pre-op LOS	Post-op LOS	ALOS
77	1.81	3.68	5.49

After Interaction: (4th Quarter 1978)

Count	Pre-op LOS	Post-op LOS	ALOS
19	1.95	2.21	4.16

HOSPITAL D:

Physician 20:

Before Interaction:

Count	Pre-op LOS	Post-op LOS	ALOS
91	1.24	4.60	5.84

After Interaction: (4th Quarter 1978)

Count	Pre-op LOS	Post-op LOS	ALOS
8	1.00	3.25	4.25

Physician 21:

Before Interaction:

Count	Pre-op LOS	Post-op LOS	ALOS
20	1.20	3.55	4.75

After Interaction: (4th Quarter 1978)

Count	Pre-op LOS	Post-op LOS	ALOS
4	1.00	3.25	4.25

Figure 6

Bilateral Lens Extraction Patients by Hospital

```
number                 mean        s.d  HOSPITAL
 obs.     pct           LOS        LOS  code

   26   41.94%         3.08       1.38   A
   15   24.19%        11.07       1.29   F
    9   14.52%         7.56       2.75   B
    3    4.84%        10.00        .82   M
    2    3.23%        10.50        .50   K
    2    3.23%         4.00       1.00   X
    1    1.61%         2.00        .00   O
    1    1.61%        10.00        .00   H
    1    1.61%         2.00        .00   J
    1    1.61%        11.00        .00   AA
    1    1.61%        11.00        .00   D
```

Figure 7

Bilateral Lens Extraction Patients by Hospital

```
HOSPITAL  0         10        20        30
         |+---------+---------+---------+----------|   SIZE    MEAN    S.D.   MEDIAN
  O      |  M                                      |      1    2.00     .00     2.00
  J      |  M                                      |      1    2.00     .00     2.00
  A      |  *M                                     |     26    3.08    1.38     3.00
  X      |  *-M*                                   |      2    4.00    1.00     4.00
  B      |     *---M                               |      9    7.56    2.75     9.00
  M      |         *M*                             |      3   10.00     .82    10.00
  H      |          M                              |      1   10.00     .00    10.00
  K      |       *--M*                             |      2   10.50     .50    10.50
  AA     |           M                             |      1   11.00     .00    11.00
  D      |           M                             |      1   11.00     .00    11.00
>>
  F      |          *M*                            |     15   11.07    1.29    11.00
   TOTAL |   *--M---*                              |     62    6.60    3.91     6.50
         |+---------+---------+---------+----------|
          0         10        20        30
```

Figure 8

Hospital A by Admitting Physician

number obs.	pct	mean LOS	s.d LOS	ADMPHYS code
8	26.67%	3.00	.00	30
3	10.00%	2.33	.47	31
2	6.67%	4.50	.50	32
2	6.67%	3.00	.00	33
1	3.33%	3.00	.00	34
1	3.33%	3.00	.00	35
1	3.33%	4.00	.00	36
1	3.33%	2.00	.00	37
1	3.33%	3.00	.00	38
1	3.33%	2.00	.00	39

Figure 9

Hospital F by Admitting Physician

number obs.	pct	mean LOS	s.d LOS	ADMPHYS code
9	60.00%	11.33	.94	10
2	13.33%	12.00	.00	11
2	13.33%	11.50	.50	10
1	6.67%	9.00	.00	16
1	6.67%	8.00	.00	17

Figure 10

DRG	Nation	Regional	Region 2	D-V PSRO	Region 3	Region 4
254	7.9	9.0	8.2	10.57	8.6	6.4

The following profile was generated based on 241 observations in the data base:

27 CELLS 241 OBSERVATIONS

No. Obs.	pct.	Mean LOS	s.d LOS	Hosp. code & name	Pre-op	Post-op	Between OP
31	12.86%	9.61	2.81		2.84	6.74	0
25	10.37	11.68	3.75		3.08	7.72	.83
23	9.54	9.70	4.57		3.57	4.61	1.84
19	7.88	10.74	4.39		3.58	7.05	0
17	7.05	10.82	5.17		3.35	6.29	1.18
16	6.64	9.81	2.10		2.19	7.36	.29
14	5.81	9.79	3.57		2.36	6.93	.58
10	4.15	13.20	5.42		2.0	10.90	0
9	3.73	10.44	2.79		not computed		
9	3.73	9.78	2.30		"		
8	3.32	11.00	5.45		"		
8	3.32	9.13	2.85		"		
8	3.32	11.00	2.74		"		
7	2.90	10.86	2.59		"		
7	2.90	12.29	3.69		"		
5	2.07	9.00	.89				
5	2.07	14.00	3.63		"		
5	2.07	11.40	3.83		"		
3	1.24	9.33	1.25		"		
2	.83	10.50	2.50		"		
2	.83	14.00	2.00		"		
2	.83	10.00	3.00		"		
2	.83	6.00	1.00		"		
1	.41	5.00	.00		"		
1	.41	9.00	.00		"		
1	.41	21.00	.00		"		
1	.41	11.00	.00		"		
241		10.57			2.97	6.92	.81

Figure 11

Physician Profiles Hospital D

Phys. #	Count	Average Pre-op LOS	Average Between-op LOS	Average Post-op LOS
13901	6	2.2	0	9.3
90056	6	3.2	3.5	7.5
90635	6	2.2	0	6.7
all others	7	4.6	0	7.0

Figure 12

MULTNOMAH FOUNDATION FOR MEDICAL CARE

Linda Jackson

Background

Multnomah Foundation is located in Portland, Oregon, with 13 hospitals and about 50,000 abstracts per year. We are probably the same as Central Massachusetts in terms of size. For our data system, we have been doing our own data entry for a year and we receive a set of regular batch reports. In terms of AUTOGRP, we have been using the system to supplement our regular batch reports, and over the past year we have about four staff people that are running AUTOGRP. Amazingly they range from sophisticated users to those who are very inexperienced or with no exposure at all. So, in terms of expertise in using AUTOGRP, we have lots of different types of people using it, and they are using it very well.

The main topic is how we have used AUTOGRP. We view AUTOGRP as a tool - a tool to help us do what we need to do. Therefore, I would like to spend some time talking about how we are using our data and the role that AUTOGRP has played in letting us analyze what's going on.

Hospital Evaluation Process

Probably one of the biggest developments we have had happened over the past year. It was the development of a hospital profile or a hospital evaluation process. Initially, when we started this process we had numerous batch reports and began hospital profiling based entirely on these reports. We did not have AUTOGRP - we did not have anything but the regular set of data elements. So, we took these data elements and displayed them over a time, the idea came to us: "Why don't we evaluate each hospital at a time." So like all PSROs we came up with a hospital evaluation process (Figure 1). As part of this process, we pulled out all the data that appears particularly relevant to a facility and display information almost exactly as in Colorado, with indicators and utilization. But we also include indicators about our review system - PA contacts, extensions, review coordinator case load - because we feel that we have to evaluate ourselves, or the review system in the hospital, as well as the hospital.

So, out of this hospital evaluation process we get a hospital profile. Besides the data profiles we include a medical care evaluation monitoring report which is concerned with the quality of the MCE's and how well they have been addressing problems and a concurrent review monitoring report which includes subjective observations about the review process and problems in the hospital. Hopefully, in the future there will also be a focused review activities report. Now, we are just finishing our first round of hospital profiles. They are to be done on a yearly basis but a complete hospital profile will be done once every two years. In the interim, there is a followup profile that addresses the problems that have been identified. This hospital profile is reviewed by the staff and the hospital's review staff because they have so much information in their head that they know about problems that we were never aware of. From there we edit and modify the profile and present it to a committee. They develop a set of recommendations, which may vary extremely. We can ask for an additional physician advisor rotating with a review coordinator, additional data to be investigated, or we can request an MCE, depending upon the information or the problems that are highlighted. I might add that the data profiles include a written summary and a set of conclusions by the data department which usually highlights the problems that will be addressed. We then meet with the hospital to present our recommendations and the response has been pretty varied. In some instances, it has been fantastic.

Some hospitals have really enjoyed it, and in fact have initiated their own activities which I will address later. Finally, we have PSRO follow-up activities and hospital follow-up activities then re-evaluation when there is time.

AUTOGRP plays a role in all aspects of this process, but mainly in developing data profiles. The data profiles that we have used in the hospital profile are not static - they are dynamic. The more experience that we have, the more data we feel that we need. Some of the things that have been included are physician profiles, which were not included in our regular batch reports, but we have screened physicians based on physician advisor contacts and terminations. At a couple of our non-delegated facilities, we highlighted a couple of physicians that we were going to focus in on. Also, recall the DRG analysis you gave us several months ago that showed the highs and lows - fantastic! Our people have enjoyed it. It supports what the review coordinators feel. At one hospital, for example, the review coordinator felt that the orthopedics unit, particularly one physician was way out of line. There were a series of DRG groups that related to orthopedics which supported her subjective observations. However, operationally, DRGs are, as Bob was mentioning earlier, difficult to implement. We usually have to go through a process of breaking them down to HICDA2 codes so that we can study it after the fact, but I think that's just another way of thinking.

AUTOGRP has also been used in the process of evaluating a mental health facility. We do not have any other mental health facilities in Portland, or Portland County, but we do have several psychiatric units. We used the COMPARE command to create s a hospital profile that compares that mental health unit to the psychiatric units in the community. The COMPARE command needs a little bit of work, but we are happy with it so far.

In order to highlight what we have been doing with hospital profiles, I am going to walk through an example of what was done with one. That's what our first reformatting of the batch reports looked like and as you can tell the staff said, let's look at one hospital at a time. We have a set of reason codes that we have used during review and this reason code says there is a post-op complication. Now, the review coordinator does not record this reason code unless there is a complication recorded in the medical record - so here we have the number of reviews associated with that reason code, the percent of reviews, and the actual days reviewed. This hospital, which was the one we were evaluating at the time, appeared to have a pretty high percentage compared to the community across the board in post-operative complications. In discussing this later on with one of the review coordinators at that facility she supported that observation wholeheartedly.

The next process we go through is to put it in graphic form (Figure 2). Now what we have here is over time, the high and low for the community (no 25th and 75th percentile because we are only dealing with 13 hospitals). Very simple and basic. The average for the community is the dotted line and the hospital is the plain black line. Here we have percent of hospital reviews and average day per review. We wondered, along with our Hospital Evaluation Committee, why we have so many post-operative complications, and one of the recommendations was to go to the data base and see if we could identify any trends or define a problem area so that action could take place. You cannot do anything based on this information alone - you have to define it so someone can talk to a physician, do an MCE, or tell the surgery department to get air conditioning.

Finally, this is what AUTOGRP provided us with. We had some direction, we knew what we wanted to look at, and so we went into the system and very simply did some basic listing and calculation of post-operative rates for the community and the hospital. These were the top six procedures - arthroplasty of knee, (26% post-operative rate, 17% for the community), hysterectomy, both abdominal and vaginal, c-section, and hernia repair. We fed some of this information back to the hospitals. For this report, we have not received any feedback from them yet. But some hospitals have initiated activities based on the hospital profiles and these types of supplementary studies. For example, one hospital had a very long length of stay, which it attributed to being a referral center. They said all their patients were from out of the area and had to stay longer. We used AUTOGRP to test the hypothesis of different lengths of stay between local and non-local patients. There was no difference. That helped us in addressing other problems where this hospital has a long length of stay. This hospital happens to be a teaching center.

There are some feelings within the community that a lot of patients are being admitted inappropriately for diagnostic work-up. We have found three hospitals have a lot of diagnostic work-ups. At one of these hospitals they are monitoring concurrently diagnostic work-ups, using criteria. Community wide, we are going to do a focus review on diagnostic work-ups based on signs and symptoms. Maybe that might help us to get a handle on a procedure problem. Based on the DRG analysis showing that one hospital had a long length of stay for T&A's, an MCE on T&A's is now being done in that institution. In two of our non-delegated facilities, we have some real problems with some physicians and this hospital showed a large number of Friday and Saturday admissions. Our review staff felt that this was due to some practices of certain physicians. We went into AUTOGRP and profiled Friday and Saturday admissions, emergency admissions, percent operating and pre-op length of stay and percent to physican advisor. This is in the process of being fed back to the hospital. Finally, one hospital, it happened to be this one, had a high rate of emergency admissions and we gave them just a basic listing of the diagnoses and they are doing an emergency room admission study. So, that is our hospital profile process in a nutshell. As I said, we have 13 hospitals and it is much easier to handle 13 hospitals than it is to handle 83.

Focus/Waived Review Project

In addition to hospital profiles, we have been involved in a focused and waived review project. I want to talk about some of the methodology and the developmental process taking place in focused and waived review. Initially, we thought we would waive by diagnosis categories. While it is not especially operationally workable, we have got 18% waived and one of the AUTOGRP capabilities which was particularly helpful in waiving review was the PROFILE command. We have a focused review coordinator who has been working with AUTOGRP. To waive review we have developed a series of data elements to consider - the PROFILE command using terminations, PA contacts, deaths, and percent discharged to SNF and ICF. This capability was very helpful in waiving by diagnosis. Unfortunately, we are running into operational problems. Our review coordinator has to look at this list of a growing number of diagnoses to determine what is waived and what is not. She spends so much time identifying the waived groups that no time is being saved.

Recently, unfortunately near the end of the project, we have tried to develop a new way of waiving review which I feel very positive about. Based on the hospital profile and the whole process we have identified many variances which need to be focused in on. They are diagnosis related, review staff related, utilization related, quality related and we feel that if we can identify the areas that need to be focused in on then theoretically we could waive the rest of the hospital. However, there is one thing that has to to happen before we can waive the rest of the hospital. Once we identify these focused categories and take them out, the hospital should be compared with the community for the "clear" categories. The CLASSIFY command is very helpful in analyzing data that way. Theoretically, you could go through each diagnosis using CLASSIFY and if the hospital falls in the high category that area should be focused in on as well. I did do an AUTOGRP session on the hospital with the post operative complications, and it appears that it is a workable methodology.

Profile Analysis System

Finally, I thought it would be a good idea to show you the role that AUTOGRP plays in our profile analysis system (Figure 3). We have our hospital evaluation profile to monitor the categories that we waive review, we have to monitor our data quality and we have to manage our review system. This area is batch reports in terms of data but this area - this is the AUTOGRP area - and it is much larger than this area by far. It includes support studies, waived review validation, topic verification, study and research, the MCE restudy (some day I hope we can get MCE's computerized and processed), special data requests and problem definition and verification study. In every one of these areas our batch reports have been basically useless - we have had to use AUTOGRP almost 95% of the time.

Q. How useful did you and your staff find the DRG batch reports?

A. We tried to look at them and tried to waive review based on the RANK reports. But, operationally they could not understand them. You would have to interpret them in terms of HICDA2 codes. In terms of the hospital profiles, the high low report summed it all up in what we needed to know, without having to look at all that other stuff. We may find a use for them in the future, but we found it a lot easier to go to the high low report because it contained what we needed to know - the analysis was basically all done - death rates and all those other problems we already had on a different level.

Q. What kind of feedback have you received from the hospitals regarding the profiles? Do they find the information useful and act on it?

A. Yes. A lot of the problems they already know about. In one hospital, we showed them that they had a surgical scheduling problem. Now this was a problem that their review coordinator had told them about time and time again, and we supplemented it with the data. What they are proceeding to do right now is trying to work out a scheduling system so that they do not have to cancel so many surgeries. With another hospital, the one with the post-op study, the data was not recorded entirely accurately. The hospital knew it, and they really came down hard on us. They said the data was not accurate, but they had to admit that it did indicate something, even though the accuracy was questionable. It has been basically sitting down with them and going through it, talking about the recommendations. Since the recommendations are developed by our Utilization Review chairman, our MC chairman and our medical director, who are fortunately all respected men in the medical community, that does have a little bit of an impact.

HOSPITAL EVALUATION PROCESS

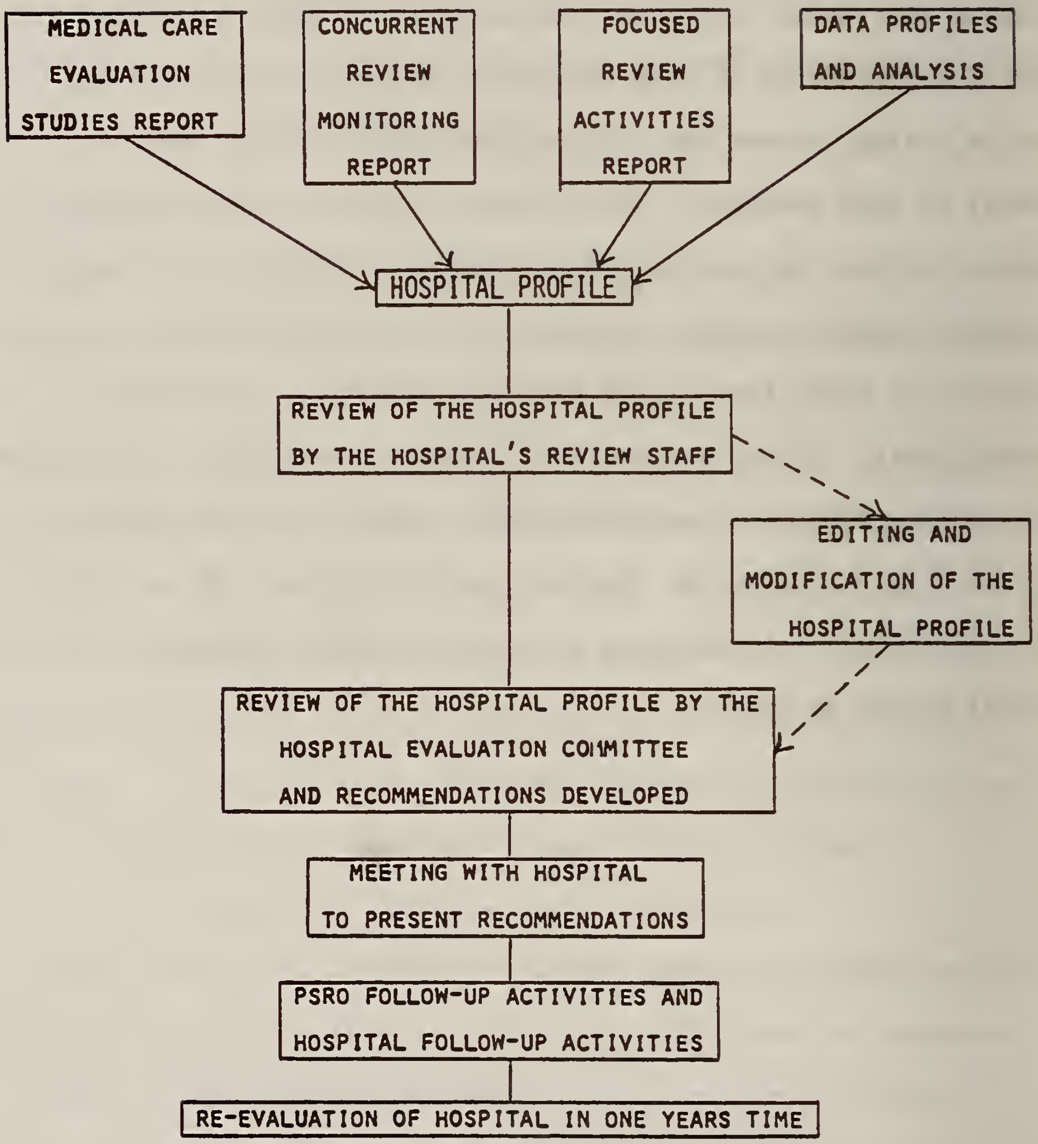

MEDICAL CARE EVALUATION STUDIES REPORT
CONCURRENT REVIEW MONITORING REPORT
FOCUSED REVIEW ACTIVITIES REPORT
DATA PROFILES AND ANALYSIS
HOSPITAL PROFILE
REVIEW OF THE HOSPITAL PROFILE BY THE HOSPITAL'S REVIEW STAFF
EDITING AND MODIFICATION OF THE HOSPITAL PROFILE
REVIEW OF THE HOSPITAL PROFILE BY THE HOSPITAL EVALUATION COMMITTEE AND RECOMMENDATIONS DEVELOPED
MEETING WITH HOSPITAL TO PRESENT RECOMMENDATIONS
PSRO FOLLOW-UP ACTIVITIES AND HOSPITAL FOLLOW-UP ACTIVITIES
RE-EVALUATION OF HOSPITAL IN ONE YEARS TIME

Figure 1

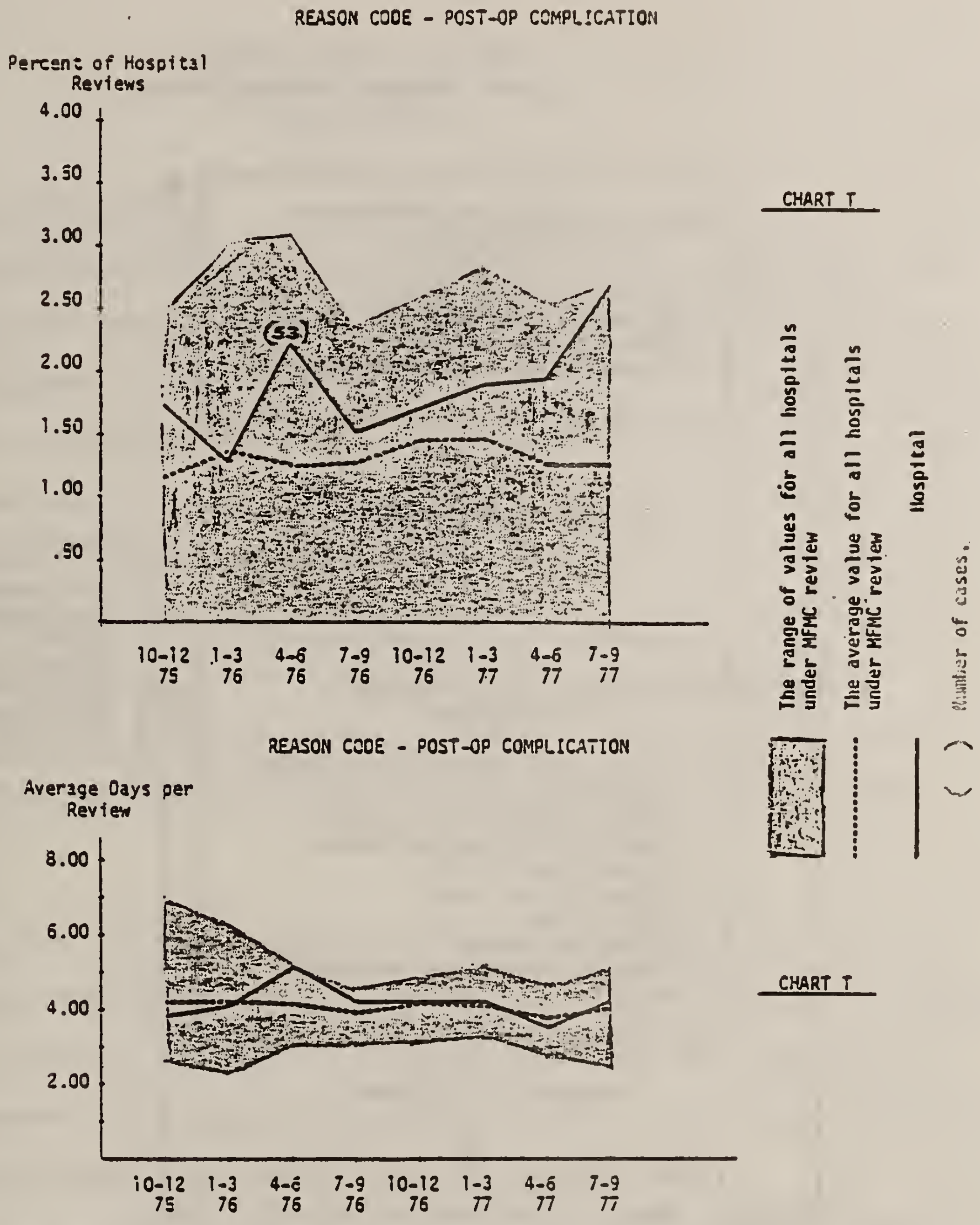

REASON CODE - POST-OP COMPLICATION
Percent of Hospital Reviews
4.00
3.50
3.00
2.50
2.00
1.50
1.00
.50
(53)
10-12 75
1-3 76
4-6 76
7-9 76
10-12 76
1-3 77
4-6 77
7-9 77
CHART T
REASON CODE - POST-OP COMPLICATION
Average Days per Review
8.00
6.00
4.00
2.00
10-12 75
1-3 76
4-6 76
7-9 76
10-12 76
1-3 77
4-6 77
7-9 77
CHART T
The range of values for all hospitals under MFMC review
The average value for all hospitals under MFMC review
Hospital
( ) Number of cases.

Figure 2

MFMC PROFILE ANALYSIS SYSTEM

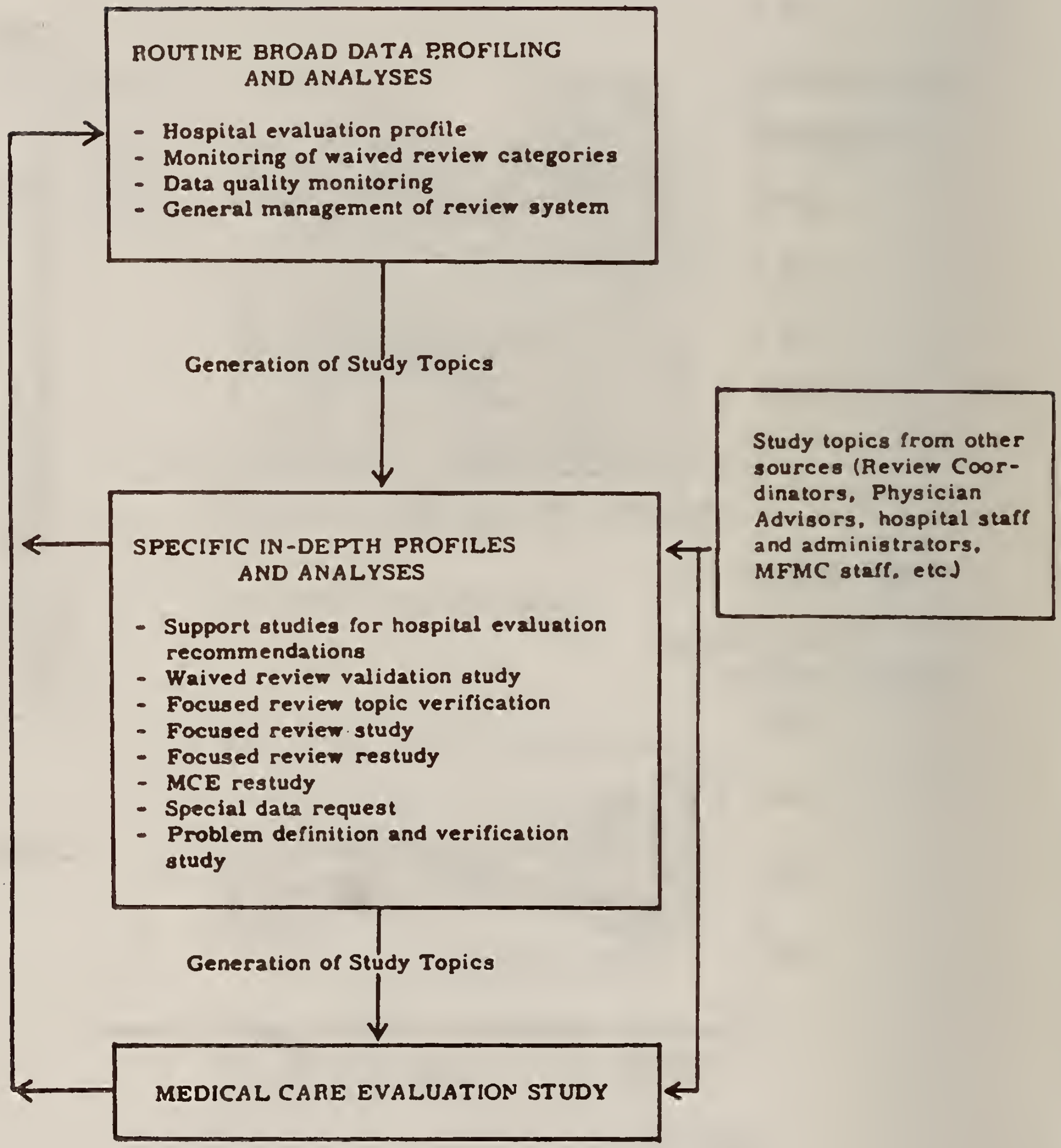

ROUTINE BROAD DATA PROFILING AND ANALYSES
- Hospital evaluation profile
- Monitoring of waived review categories
- Data quality monitoring
- General management of review system
Generation of Study Topics
SPECIFIC IN-DEPTH PROFILES AND ANALYSES
- Support studies for hospital evaluation recommendations
- Waived review validation study
- Focused review topic verification
- Focused review study
- Focused review restudy
- MCE restudy
- Special data request
- Problem definition and verification study
Study topics from other sources (Review Coordinators, Physician Advisors, hospital staff and administrators, MFMC staff, etc.)
Generation of Study Topics
MEDICAL CARE EVALUATION STUDY

Figure 3

PASADENA AREA XVIII PSRO

Bonnie Klein

Introduction by Dr. Fetter

This site has participated in our mini data entry system experiment. No processor has been involved with Pasadena Area 18, rather they are acting as their own processor utilizing an LSI/11 micro computer, an associated disk file and a couple of terminals. If there is any interest, we can describe in greater detail how the system was set up there and how it operates without a processor. We will determine what the cost benefits are of that kind of an arrangement, that is the capability not just to utilize AUTOGRP but to enter data and have available at the moment for analysis display reporting and so on without any significant time lag in looking at those records. The idea is to integrate as much as possible the AUTOGRP capability into a total data processing system.

Background

At Area 18 we are using AUTOGRP in two manners. One is the way Bob was describing with information collected through the data entry system. In addition, we purchased baseline data tapes from abstracting services for eleven of our eighteen hospitals and analyzed this data with AUTOGRP. I am going to present today some of the ways which we have used both these data sources.

To give you an idea of what Area 18 looks like, we have eighteen hospital and about 50,000 discharges a year. Half of the hospitals are delegated and half non-delegated.(Figure 1). We became conditional in January, started operations in early April, and were implemented in all our hospitals by August of this year. For this reason the data that I have is not the complete data for the PSRO, since it was not until August of this year that we were collecting data for patients in all the hospitals.

Analysis of Baseline Data

I have been looking at data from these hospitals prior to PSRO implementation with some of the same kinds of groupings that, for example Colorado, was discussing - by bed size, by occupancy rates, by average length of stay to see if there were any patterns on which PSRO review might have impact. In fact, these analysis did help us in making decisions about delegation and in considering factors such as occupancy and length of stay that might affect review costs. It has also enabled us to look at some of the trends in our hospitals between 1975 and 1978.

We have a fairly tight group of hospitals as you can see by just looking at the overall length of stay (Figure 2). When the list of DRGs that were going to be monitored for PSROs was originally distributed, I searched the data base and made a file containing 1976 records for all the hospitals. (1976 because our baseline year, since we have data for the entire year for almost all our hospitals.) From this file I generated Area 18 averages corresponding to those DRGs and compared them to the Western region averages (Figure 3).

One of the other things that I looked at with the baseline data was elective surgical procedures. I took the eleven elective surgeries for which the PSRO National Council had developed criteria and decided to review them in our area. Most of this work was done prior to implementation or just as we were about to implement them in the hospitals. Instead of just considering frequencies, I also looked at the percentage of total discharges which these surgeries represented.

Some of the rates were far more stable than I had expected, but there were differences that appeared worth exploring. We went over the data with one of our physician committees, and everywhere that a hospital varied beyond the others in terms of percentages of discharges, we did some additional work trying to explain the variations. None of this material from the baseline data went back to the hospitals. We were only experimenting with our own utilization of the data in terms of what we could do and what kinds of inhouse decisions could be made based on it. The major use of this data was on delegation decisions. For example, our analysis revealed that one hospital (a rather respected institution in the area that was relatively assured of being delegated) was higher then the area average for length of stay on 275 DRGs and low on only four. This was not the pattern with any of our other hospitals. They became non-delegated for a 6 month trial period while we looked into their Utilization Review system in greater depth.

AREA XVIII P.S.R.O. HOSPITAL CHARACTERISTICS

CHARACTERISTICS	DELEGATED (N=8)	NON-DELEGATED (N=10)	ALL HOSPITALS (N=18)
BED SIZE			
Mean	201.5	149.1	172.4
Range	85 - 565	27 - 452	27 - 565 (TOT.3103)
OCCUPANCY			
Mean%	62.5%	56.3%	59.2%
Range	27.3 - 80.0	30.0 - 90.0	27.3 - 90.0
MEDICAL SCHOOL AFFILIATION			
Number	1	0	1
Percent	12.5	*	5.5
RESIDENCY PROGRAM			
Number	1	1	2
Percent	12.5	10.0	11.1
TOTAL DISCHARGES/YEAR	48,235	42,821	91,056
Mean/Hosp/Year	6029.4	4282.1	5058.7
Range	657 - 18,388	364 - 15,824	364 - 18,388
MEDICARE DISCHARGES/YEAR	19,767	18,741	38,508
Mean/Hosp/Year	2470.8	1874.1	2139.3
Range	80 - 8153	162 - 7227	80 - 8153
MEDI-CAL DISCHARGES/YEAR	7027	5070	12,097
Mean/Hosp/Year	878.4	507.0	672.1
Range	49 - 1911	76 - 2027	49 - 2027
COST PER REVIEW			
Average	$8.69	$7.06	$7.96
Range			

Figure 1

1976 DATE ON AREA HOSPITALS FOR MEDICARE DISCHARGES
1976: 2882.4 Days/1000 Enrollees
291.1 Adm./1000 Enrollees

BED SIZE CATEGORIES	OCCUPANCY RATE (%)	1976 ALOS (MCARE)	1976 TOTAL DISCH.	1976 TOTAL DAYS
I. <150 beds				
7. [redacted] (115)	43	9.00*	898	8,082*
10. [redacted] (85)	52	17.23	438	7,547
12. [redacted] (96)	80.3	8.3 *	1302	10,807*
13. [redacted] (31)	NA	11.00*	363	3,993*
15. [redacted]. (86)	30	10.61	496	5,263
17. [redacted] (82)	33	7.80	634	4,945
II. 150-300 beds				
1. [redacted]. (157)	27.3	8.61	1021	8,791
3. [redacted] (184)	70	9.63	2914	28,062
4. [redacted] (229)	64.3	8.32	2257	18,778
6. [redacted]. (152)	43	9.80	1190	11,662
18. [redacted]. (167)	62	10.23	1839	18,813
19. [redacted] (150)	NA	8.5 *	2327	19,780
III. >300 beds				
5. [redacted] (452)	76.7	12.15	5147	62,536
8. [redacted] (565)	74.4	10.18	5541	56,407
11. [redacted]. (310)	NA	9.61	3753	36,066
TOTAL		9.9**	30,120	293,459

* Based on Blue Cross FI Data
**HCFA Data

Figure 2

COMPARISON OF AREA XVIII PSRO (1976 DATA) AND WESTERN REGION (PHDDS TAPES) ON DIAGNOSTIC GROUPS BEING MONITORED BY HSQB

DRAFT

DRG. NO.	SELECTED DETAILED DIAGNOSIS GROUP	WEST REG. (1-6/77)	AREA 18 PSRO (1976)	PERCENT OF FED. DISCH'S
		Aver.LOS	Aver.LOS	%
74	DIABETES, AGE > 35 W/O OP W/O 2ND DX	6.3	8.4	0.6
92	NEUROSES, PERSONALITY DISORDERS	8.6	13.9	0.5
110	DIS OF EYE WITH EXTRACTION OF LENS	3.6	4.5	4.7
121	ACUTE MYOCARDIAL INFARCTION	12.4	13.4	2.2
122	ISCHEMIC HEART DIS, W/O OP W/O 2ND DX	4.3	6.2	0.4
141	CEREB THROMBO-EMBOL W/O OP, W/O 2ND DX	7.2	7.8	0.4
159	HYPERTROPHY OF T & A	1.7	2.1	0.5
161	ACUTE UPPER RESP. INF. & INFLU. AGE > 44	5.3	7.4	0.4
165	PNEUMONIA, AGE < 31	4.8	**	**
166	PNEUMONIA, AGE > 30, W/O OP W/O 2ND DX	6.7	8.1	0.4
183	GASTRIC & PEPTIC ULCER W/O OP W/O 2ND DX	5.3	**	**
204	HERNIA OF ABD CAV, AGE > 64 W/MINOR REPAIR	5.1	6.1	1.21
227	DIS OF GB & BILE DUCT WITH OP, W/O 2ND DX	9.0	9.9	0.5
254	DIS PROSTATE, W/TRANSUR PROST, W/O 2ND DX	6.1	8.0	0.3
266	DIS OF FEM GEN ORG W/HYSTEREC, OTH MAJ OP	7.0	9.1	0.7
278	NORMAL DELIVERY, W/O OP OR W/MINOR OP	2.6	2.8	1.6
294	ARTHRITIS W/REPAIR, PLASTIC OP, LAMNECTMY	14.5	19.6	0.3
340	FRACTURE OF FEMUR, PELVIS, MULT W/O OP	12.4	14.3	0.4

* Data Available for 9 of 18 Hospitals Only

Figure 3

WISCONSIN PROFESSIONAL REVIEW ORGANIZATION

Ed Sikes

Background

The Wisconsin Professional Review Organization or WisPRO covers an area including 65 of Wisconsin's 72 counties. We have 111 acute care hospitals with about 180,000 discharges per year. We have been collecting the data from most of the hospitals for two years and all of them for at least 18 months. And, we have been involved with AUTOGRP for two years. So we have a good bit of experience.

Derivation of Utilization Index from Case Mix Report

The first thing I would like to tell you about is our approach trying to get one single number to measure utilization - for a number of different reasons. If we just look at average length of stay overall, or for Medicare and Medicaid separately, and compare hospitals we do not get a fair compariosn as case mix makes a lot of difference. So, we have made extensive use of the AUTOGRP case mix report in developing one single index.

Before I show you what calculations we go through, let me say that this utilization index is based on a case mix report, which means it is ultimately based on DRGs, so we felt we had to sell that concept to the doctors and to the hospitals. It has been a little bumpy road at times, but we think we are doing pretty well now. The doctors for a time were fairly comfortable with the concept of the DRGs and all of a sudden there was a flare-up. They questioned the contents of one of the groups. We talked to Bob about that, and there are still some problems with it in terms of how it looks. But they reviewed it again and cannot seem to do anything better with that particular group currently. The label may be a little misleading for our PSRO. I think the title mentions VD, but for our PSRO most of the cases in this DRG are for gastroenteritis and colitis. That caused the doctors some concern.

Comment from Dr. Fetter:

New Jersey has gone through and changed some of the titles and actually I prefer the New Jersey names better than our original names. If anybody would like that list of names or labels for the DRGs, they are available. Actually, they had some physicians look at the groups to find out what mainly was in them and made the names more meaningful.

So, we have had some problems there with misinterpretation. Also, WISPRO doctors say the the term Diagnostic Related Groups makes them think in terms of primary discharge diagnosis only. We have tried to emphasize to them that the DRGs were developed using length of stay statistics, and that their starting point was for evaluating utilization rather than quality of care. When we put in all those caveats and qualifications we have gotten them to accept the idea of using DRGs.

In the big package of reports we get from the Center, there is a report called the case mix report which gives us an idea of how the hospitals compare on utilization, case mix, and so on. We have taken a few statistics from there. We have found that trying to use that whole page as it comes off the computer would be very confusing even if the physician committee is famililar with the data. I must comment that I think some of the column headings are a little confusing - a little misleading - so we have taken statistics from there and reformatted them. The case mix report uses a breakdown of each hospital's cases in the 383 DRGs (Figure 1). We get the hospital's actual length of stay by combining the percentage of the cases that fall in each DRG with its actual length of stay for each DRG. When we take the WISPRO wide length of stay and compare it with the hospital's actual frequency of cases we get a hypothetical figure called the standard performance length of stay, which indicates the length of stay WISPRO theoretically would have had for that hospital's case mix. Then we take the actual length of stay, divide it by the standard performance length of stay, to get an idea of how the hospital compares to WISPRO using its own case mix. So, this number is going to be in the range of .8 to 1.2, something on that order. For example, if it is 1.05 then the hospital is using 5 percent more days to treat this case mix than theoretically the whole PSRO would have done for that same case mix. If it is .9, then they are using 10 percent less days. I have some actual figures here from one of our districts (Figure 2). Here we had a range from .81 to 1.14.

In the case mix report there is an index called LOS Performance Index which compares the hospital with the PSRO using the PSRO wide case mix. We felt that in talking with the hospitals it is better to use their own case mix as a standard -- that they would be more willing to compare their length of stay with the PSRO wide length of stay based on that hospital's own case mix. Our actual range of values was from .67 to 1.19.

Applications of Utilization Index

We made use of this index in a couple of different ways. First of all in our focused review program, one of the main criteria that was used was whether or not the utilization index was greater than 1.1. Let me comment that our focused review program sounds a bit different from the others that I have heard mentioned. Ours is almost strictly on a random basis. There has been at least one diagnosis that has been focused out - normal deliveries. But other than that, hospitals which have passed two criteria, one being in terms of the utilization index, have been granted 50 percent review based on this random selection. This is just getting off the ground now. They have to submit to WISPRO plans for making that random selection.

The other way we are using this index is in terms of our year's objective which we submitted to HEW for fiscal year 1979. We looked at hospitals which have a utilization index greater than 1.10 and we have asked them to try to reduce down to at least half way to the 1.10 limit during the fiscal year. For example, if they are at 1.16 we asked them to try to get down to 1.13, halfway down to 1.10. At the other extreme, we are looking at hospitals that have a utilization index less than .81. We do not have any in this district, but we do have some in the other districts. And, we have not asked them to increase their utilization index but we are studying to see why that was. We have identified eighteen hospitals out of 111 who are above the 1.10 cut off and we have informed them of their high DRGs. We have tried to emphasize to the hospitals that these just happened to be the DRGs which were statistically significantly high. They may have problems in other areas, but there were not enough cases for the statistical tests to flag them.

Unfortunately, hospitals tend to take this sort of thing as an accusation on each individual DRG and try to justify it. We tried to get across the message that we were concerned with their overall utilization.

One other thing that we did with these hospitals that had a high utilization index was to try to look at the effect of days awaiting transfer to long-term care. There seems to be a problem in how PSROs should look at that problem. But at any rate, we looked at the data and we found that it was not significantly affecting the utilization index for most of these hospitals. Also, we identified 8 hospitals which were low on the utilization index and we informed them of the DRGs that they were low on. We looked at the percent of patients who were being transferred to another acute care hospital. For the 8 hospitals grouped together, their percentage of transfers out to another acute care hospital was about twice that of WisPRO as a whole. But some of them had practically none, and we concluded that for any individual hospital that was not the whole explanation.

Finally, we have used the Hi/Low DRG Report in one other way. When our field staff goes into hospitals for a monitoring and evaluation visit, they look at their overall review process in the hospital. They ask for a certain number of charts to review, and they have sometimes used the Hi/Low Report to identify the DRGs where they should request charts. The hospitals have been very surprised and have asked: "How did you know exactly where my problems are?" They knew they had problems in the area - they were surprised the WISPRO people could identify them.

Physician Profiles

We initially selected 41 physicians to profile. Some of the profiles were not very interesting. But some of the other things that we noticed were very large volumes of cases for some of the physicians -- like 500-600 program admissions per year. There is a question as to whether they can be caring for that many patients. There were some physicians who had a large number of pain diagnoses - back pain, chest pain, and abdominal pain as the discharge diagnosis. A few of them is okay, but a large number of them as the primary discharge diagnosis, and staying for a long time looks a little strange. High frequencies for some of the diagnoses and procedures were questioned - T & A's, URI, or uncomplicated diabetes. We were curious as to what was going on. So, we did a followup on a number of these profiles to provide some back-up information. We have at times provided comparative length of stay statistics for the physician's specialty and for his area by diagnosis and procedure.

As in this instance, we looked at individual cases (Figure 3). This particular doctor, for the first half of 1978, his most common primary discharge diagnosis was pathologic fracture which was not extremely common among the other orthopedic surgeons. So, the physician committee looked at these individual cases to see what the other diagnoses and procedures were, length of stay, age, and so forth. We have done a number of these things for other physicians. And, finally, in many cases we list the chart numbers so they can begin the hospital review of certain cases by WISPRO or by the Utilization Review Committee in a hospital. In general, there haven't been any sanctions taken. Mostly the hospitals have been somewhat defensive, or if they have criticized the physicians, it has been off the record, although we have noticed some improvement in subtle things. They may not admit there is something wrong, but we have seen a difference. For example, three physicians who had a very high volume of cases have reduced that volume. Two of the physicians have almost completely eliminated cases of T & A's, where they were having a problem. One orthopedic surgeon has reduced his overall average length of stay drastically. The new profile for this institution shows no patients with traction or cast immobilization as the primary procedure. Another physician has reduced his volume of pain diagnoses. So either he is not admitting the patients or he is coming up with more definitive diagnoses.

Age Adjustment for Mortality Rates

The next thing I would like to talk about is age-adjustment for mortality rates. We try to become more and more aware of making adjustments in order to make fair comparisons. I already indicated that we use the utilization index to try to adjust for case mix. Whenever we have large volumes of cases and are comparing different hospitals for mortality, we try to adjust for age. Here, we looked at ischemic heart disease for elderly patients age 65 to 104 and we compared WISPRO's five bed size categories, which you see here (Figure 4). It has been hypothesized at times that the smallest bed size category, hospitals under 50 beds, do not have adequate equipment, practice, etc., for treating heart disease patients. So when we ran a statistical test on the unadjusted mortality rate, the mortality rate for the small hospitals as compared to the overall mortality rate was statistically significant at the 1 percent level. But, after doing age adjustment the mortality rate drops here, and some of the others go up a little bit. It turns out that comparing mortality rate for small hospitals overall is not even significant at the 5 percent level. So, we avoided making that perhaps unfair conclusion by age adjustment.

We did a study of 21 procedure groups which account for about 70 percent of our overall surgical deaths. We looked at mortality rates within these groups for different five-year age groups. We were trying to measure the increased surgical risk as age increases. There we adjusted for procedure mix in order to make a fair comparison. We wanted to make sure that if an age group had a high mortality rate, it was not due to higher frequency of performance for those procedures. We did find a substantial increase in surgical risk at about age 75-80. I understand that physicians used to feel that this increased risk was about at age 65. It has moved up, so that the risk for age 65 is about the same as that for age 40.

CASE MIX REPORT

Diagnostically Related Groups	Percentage of Hospital's Patients in Each Group
1	.2
.	.
.	.
.	.
383	.13
	100

Hospital LOS for Each DRG	Percentage of Hospital's Patients in Diagnostically Related Groups	WisPRO LOS for Each DRG
7.6	1	7.5
.	.	.
.	.	.
.	.	.
8.0	383	8.0
ACTUAL HOSPITAL LOS		STANDARD PERFORMANCE LOS

$$\text{UTILIZATION INDEX} = \frac{\text{ACTUAL HOSPITAL LOS}}{\text{STANDARD PERFORMANCE LOS}}$$

Figure 1

STANDARDIZED LOS
WEST CENTRAL DISTRICT
CALENDAR YEAR 1977

Hospital	Actual Hospital LOS	Standard Performance LOS	Difference	Utilization Index (Actual Hospital LOS ÷ Standard Performance LOS)
A	8.3	7.3	1.0	1.14
B	8.5	7.6	.9	1.12
C	8.9	8.0	.9	1.11
D	8.2	7.4	.8	1.11
E	8.6	7.9	.7	1.09
F	9.4	9.2	.2	1.02
G	7.3	7.3	-	1.00
H	7.0	7.4	-.4	.95
I	7.9	8.9	-1.0	.89
J	6.3	7.4	-1.1	.85
K	6.8	8.2	-1.4	.83
L	5.5	6.8	-1.3	.81
M	6.4	7.9	-1.5	.81

Figure 2

CASES of PATHOLOGIC FRACTURE for DOCTOR JJ
(first half 1978)

Primary Discharge Diagnosis Pathologic Fracture (721.0)

Case #1

Hospital A Chart Number - 2445286
Discharged 02/15/78
LOS - 16
Age - 79
Adm. Dx - 805.4 Fracture of Vertebral Column without mention of Spinal Cord Lesion - Lumbar, Closed
Dx2 - 723.2 Osteitis Deformans---

Case #2

Hospital A Chart Number - 2455012
Discharged 03/28/78
LOS - 15
Age - 75
Adm. Dx - 789.1 Pain in Back
Dx2 - 723.0 Osteoporosis
Dx3 - 401.0 Essential Benign Hypertension

Case #3

Hospital A Chart Number - 2460079
Discharged 04/17/78
LOS - 13
Age - 79
Adm. Dx - 721.0 Pathologic Fracture
Dx2 - 723.0 Osteoporosis

Case #4

Hospital A Chart Number - 2462620
Discharged 04/25/78
LOS - 9
Age - 80
Adm. Dx - 846.0 Musculoskeletal Injuries of Sacroiliac Region
Dx2 - 723.0 Osteoporosis

Figure 3

Ischemic Heart Disease (H-ICDA codes 410 - 416.9)
among patients aged 65 to 104
mortality rates for bedsize categories (1977)

Bedsize Category	Number of Cases	Mortality Rate	Age-Adjusted Mortality Rate*
A: 1-49 Beds	1029	16.0%	15.1%
B: 50-99 Beds	1868	13.7%	13.3%
C: 100-199 Beds	1351	13.3%	13.1%
D: 200-299 Beds	2084	12.4%	12.7%
E: 300+ Beds	2766	12.9%	13.2%
ALL	9098	13.4%	

*Using 5-year age intervals.

The un-adjusted mortality rate for bedsize category A is statistically significantly high, but the age-adjusted mortality rate is not.

Figure 4

ESSEX PHYSICIANS REVIEW ORGANIZATION

Clyde Hanks

Background

We have a data system and a processing contract with Optimum Systems. Because of our interest in the work here and the fact that Optimum Systems purchased the AUTOGRP software, we kept coming to the meetings and after a while started to get invited. I would like to show you briefly what our data system looks like (Figure 1).

We have two abstract systems at work in the hospitals-NJUP and PAS. These abstracts are completed in medical records by medical records coders and abstracters. They send monthly tapes to Optimum Systems, who performs additional edits above and beyond the collectors. If they find errors, they send them to the PSRO and we then forward them back to the hospitals for corrections. They merge these into a common data base from which we get some quarterly reports. They produce a PHDDS tape and management reports. Over our terminal we have available to us AUTOGRP, SPSS, and EASYTRIEVE. EASYTRIEVE is a sort, select, and report format software package and does tasks very similar to AUTOSEL. Also, they have just added SAS in the last month and we have done a couple of reports with that.

Profile Analysis

We got into the profile area because we are one of the demonstration projects in profile analysis. We made our application for that demonstration project on the basis that we wanted to use profile analysis to focus our review system. That was the goal that we had going in, and most of the profiling that we have done has been with that objective in mind. Most, say 90 percent of the work, has been just in looking at profiles. We had the following goals and objectives for that:

1) to demonstrate improved review utilization and quality resulting from focusing in of review,
2) to demonstrate a savings in reduced staff time and money by focusing out review without increasing utilization and decreasing quality,
3) to develop some standard organizational modifications to conduct focused review,
4) to develop profile analysis strategies and algorithms to support focused review, and
5) to effectively share with all interested parties the experience gained from the focusing project.

We are working on the last stage now. In this coming year, we are one of the PSROs who will be supported by the profile analysis contract that Interqual has in consolidating what the demonstration projects did and what lessons they learned.

I would like to share with you an early profile that we did, then discuss briefly one that we did more recently to see some of the differences that we had and why we had them (Figure 2). One of the first profiles that I tried to put together was on pneumonia. As you can see the average length of stay goes from 9.8 days to 18 days, which is a fair range over a number of hospitals. With AUTOGRP you can try to look for some reasons as to why there might be that range of length of stay. So, we did an analysis looking at the effects of age (Figure 3). We looked at patients less than 2, 2 through 15, 16 through 60, and over 60. You can see that the average length of stay goes from 6.51, to 6.78, to 12.06, to 15.57. Thus, there really is an effect here of age on the average length of stay. We find in some hospitals - for example hospital B has 51 patients in this age group, which is the highest of all their groups, whereas other hospitals have most of their patients in the older age groups. There were alot of very young patients, not that many in middle ages and alot of very old ones. As you might guess we are dealing with hospitals that have a large Medicaid population, dealing with infant pneumonia, and we have hospitals that treat an extensive Medicare population dealing with pneumonia in the older population.

We then get into an analysis based on the DRGs (Figure 4). There are four DRGs for pneumonia and 165 and 166 are on this chart. DRG 165 contains patients who are 30 years or younger with an outlier limit of 20 days and no procedures done. The bottom line where it says "all" is for the state's 1976 discharges which we put on the bottom to give some comparison for us. The hospitals' average lengths of stay are around 7 to 9 days and the number of patients is anything from 77 down to 9. The hospital with the most patients had the shortest length of stay, the hospital with the second most had one of the longer lengths of stay. Group 166 contains patients over 30 years of age, with no procedures. The outlier on this DRG was 25 days and we included only live discharges. You might characterize this DRG as patients, at least as far as the abstract goes, who just had pneumonia without being very complicated. The average length of stay varies from 6 days in this hospital with 33 patients to 12.7 days in this other hospital with 34 patients. Those are interesting variations and revealed something that we felt we might want to look at. With respect to death rate, the state average was 8.3. There were no deaths in our hospital except for one which had a death rate of 15.8.

The next two DRGs also relate to pneumonia. DRG 167 contains patients over 30, with no procedures, but they had one or more secondary diagnoses. The outlier limit here was 38 days, and again it is all live discharges. The average length of stay for the hospital with the high death rate is 25 days for 24 patients. The hospitals vary all over the place but the numbers of patients are often small, so one wonders how significant the rates are. DRG 168 is pneumonia patients who had procedures done and there are not very many of them except in one hospital. The average length of stay varies quite a bit, but again there are very small numbers of patients and it is a long length of stay DRG.

There are three hospitals on there that stand out - two for length of stay and the bottom one for both length of stay and death rate. We sent the profiles to those hospitals asking them to explain the figures. The two with just length of stay problems wrote back and said: This is too complicated - we can't even understand it. The one who had the death rate said the same thing but they did do an MCE on it, for which we have not seen results.

The lesson we learned - and it was a very important lesson, was to keep things simple because these things are being presented to other people. It was not successful at all and as a result I would be willing to bet that there has not been any impact at all from that profile.

This was one of our more successful profiles (Figure 5). We took three hospitals which were similar in size and constituency and modified one of our existing profiles on average length of stay for cholecystectomy by hospital. We found one hospital which was way way above the others and it also seemed to be very specific to pre-op length of stay. We profiled the hospital and using AUTOGRP tried to find reasons for variance in the length of stay. We found that there were essentially three explanations for why the length of stay varies: 1) the age of the patient, with older patients staying longer, 2) the admission class, emergency or urgent admissions staying longer than elective admissions and 3) whether or not the admitting physician was the surgeon on record. We found that whenever the admitting physician was not the surgeon there was on the average at least one extra day pre-op, which we attributed to the patient transfer from the admitting internist, GP, whatever, to the surgeon. For the one hospital that we zereoed in on, the admitting physician was not the surgeon 75 percent of the time, as compared to 25 percent for the other two hospitals. This is a very elaborate profile but we did not show it to the hospitals. We distilled out of it very simple graphic statements on a single page, indicating where the problem was. We went to the hospital and presented the data in a physician to physician manner. The data was used mainly as back up, with most of the explanation verbal rather than a piece of paper. We have seen a change in the length of stay in the hospital. Because the hospital was delegated, we left the method of change up to them. We did not tell them that the admitting physician had to be the surgeon in 25 percent of the cases, we just told them that they had to bring their length of stay in line with the county and with the comparable hospitals. It was up to them to figure out how to do it. They have strengthened concurrent reviews and focused in, opened a PAT unit (pre-admission testing unit), and had a couple of conferences with both internists and surgeons to bring the problem to light.

Future Work

Where do we go from here? The PSRO has a number of tasks in front of them in the next six months. One of these is to start reprofiling all the areas that we have profiled and focused on to see if utilization has changed. We want to start using the data system much more in monitoring. As we have all our hospitals implemented and the whole PSRO turns to a problem solving organization, we can use the data to help us choose our monitoring visits, which are probably three times a year to a hospital. We also want to try to do some of the things that Barbara was talking about this morning, that is to use data processing in support of MCEs both to choose topics and to help analyze the data when it comes back. Finally, we want to start doing physician profiles to focus in and focus out by physician. The biggest hurdle here has been political force in that the physician committees in the hospitals have not been that anxious to stand up and say: this physician was focused out and this physician was focused in. Through constant discussions and bringing the topic up in front of them again and again, they have just recently been willing to do that if a hospital requests that it be done in its institution. That's a big step for us. In the near future they are going to have to develop physician profiles and some criteria for focusing in and focusing out a physician.

N J PSROs

DATA FLOW CHART

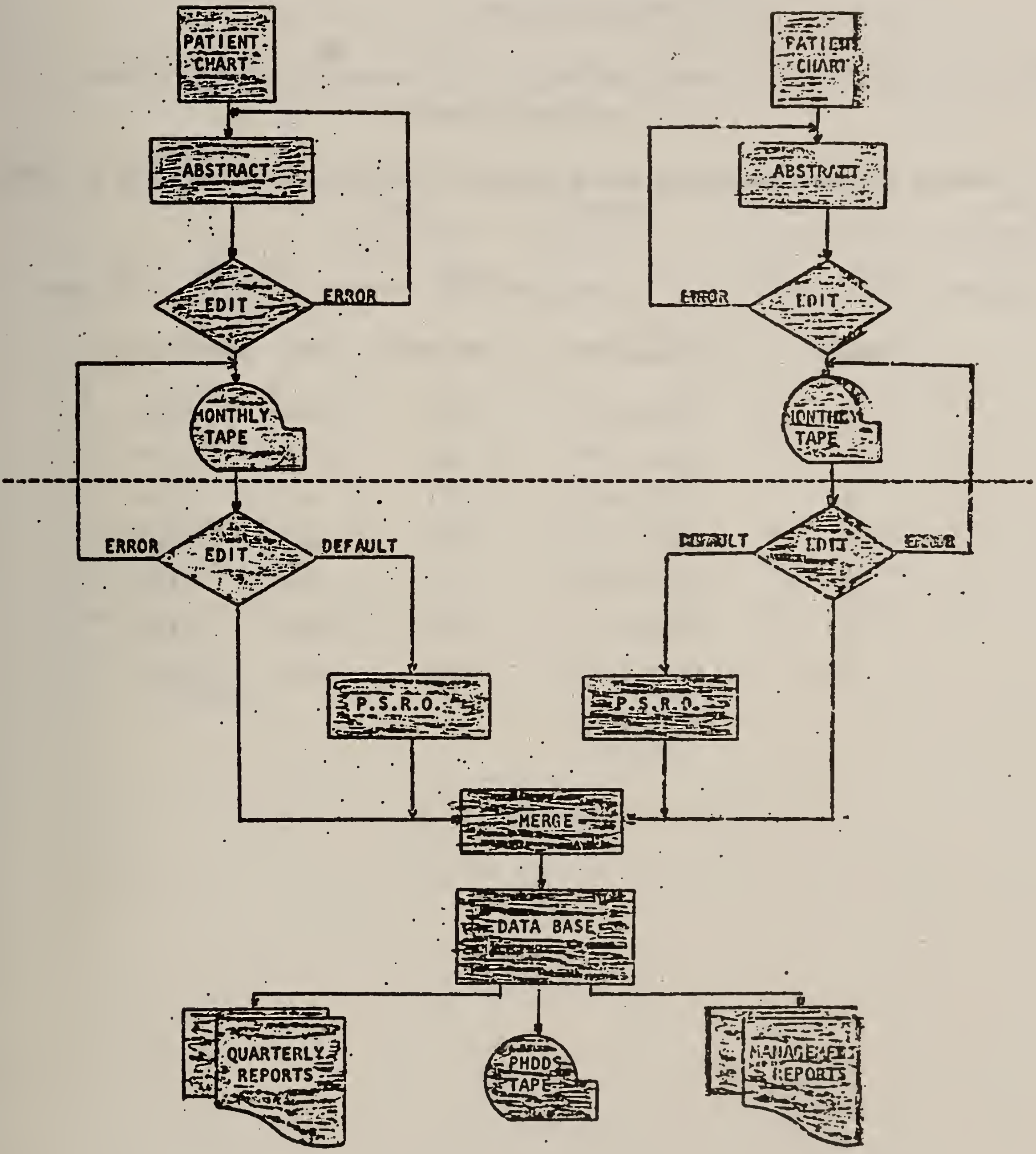


Figure 1

Pneumonia Profile 1

Federal Patients Discharged with a Principal Diagnosis of 480.0 - 486.9 (ICDA-8)

Hospital	Data Discharge Dates	Patients	Days	Average LOS
A	4/77-8/77	47	564	12.00
B	10/76-7/77	120	1176	9.80
C	7/77-9/77	16	198	12.38
D	2/77-6/77	21	207	9.86
E	1/77-8/77	71	666	9.38
F	10/76-9/77	57	1028	18.04
All	10/76-9/77 (41 Hospital Months)	332	3839	11.56

Figure 2

Pneumonia Profile 2

Federal Patients Discharged with a Principal Diagnosis of 480.0 - 486.9 (ICDA-8)

		AGE<2		1<AGE<16		15<AGE<61		60<AGE	
Hospital	Data Discharge Dates	# Patients	Avg LOS	# Patients	Avg LOS	# Patients	Avg LOS	# Patients	Avg LOS
A	4/77-8/77	3	7.66	7	5.14	5	6.40	32	14.78
B	10/76-7/77	51	5.60	21	5.04	17	15.23	31	16.93
C	7/77-9/77	-	-	-	-	1	4.00	15	12.93
D	2/77-6/77	4	8.75	1	8.06	6	9.00	10	11.00
E	1/77-8/77	24	9.12	19	8.84	8	8.12	20	10.70
F	10/76-9/77	-	-	3	9.33	11	15.00	43	19.41
All	10/76-9/77 (41 Hospital Months)	82	6.51	51	6.78	48	12.06	151	15.57

Figure 3

Pneumonia Profile 3

	DRG 165						DRG 166					
	Patients		Average LOS		Death Rate %		Patients		Average LOS		Death Rate %	
Hospital	All 1976	EPRO	All 1976	EPRO	All 1976	EPRO	All 1976	EPRO	All 1976	EPRO	All 1976	EPRO
A	118	11	6.7	5.7	.0	.0	33	1	9.3	6.0	.0	.0
B	231	77	4.8	5.2	.4	.0	22	5	8.9	6.8	8.3	.0
C	67	0	6.2	-	1.5	-	24	3	8.3	4.7	.0	.0
D	22	9	10.4	9.0	.0	.0	12	5	10.1	10.0	.0	.0
E	141	44	7.3	7.9	.0	.0	39	2	9.7	10.5	.0	.0
F	53	5	7.5	7.4	.0	.0	34	15	7.9	12.7	2.7	15.8
All	8441	146	6.9	6.4	.5	.0	1948	31	8.4	10.2	2.9	8.3

Pneumonia Profile 3

	DRG 167						DRG 168					
	Patients		Average LOS		Death Rate %		Patients		Average LOS		Death Rate %	
Hospital	All 1976	EPRO	All 1976	EPRO	All 1976	EPRO	All 1976	EPRO	All 1976	EPRO	All 1976	EPRO
A	90	7	12.9	11.1	15.6	30.0	17	20	21.5	16.7	5.3	20.0
B	71	22	13.3	17.7	13.1	18.5	19	5	22.2	28.2	5.0	33.3
C	70	6	11.1	11.7	15.7	14.3	29	4	17.1	12.5	14.7	33.3
D	33	4	14.2	6.5	.0	.0	7	3	18.7	16.7	.0	.0
E	62	12	12.3	12.5	21.5	36.8	5	3	24.6	14.7	20.0	.0
F	44	24	12.6	25.4	4.3	27.3	0	0	-	-	-	-
All	5579	75	12.2	17.6	14.7	25.0	1226	35	19.5	17.7	14.4	21.7

Figure 4

SUMMARY STATISTICS ON CHOLECYSTECTOMIES

GROUP	Count	TOTAL LOS			Average Pre-Op Days		
		Median LOS	Mean LOS	S.D.	Median Pre-Op	Mean Pre-Op	S.D. Pre-
Principal Proc = Choly (Choly 1)	289	14	16.55	9.98	4	5.83	5.47
Choly 1 w/o deaths & stays>31 days (Choly 2)	267	14	14.53	5.88	4	5.12	4.43
Choly 2 w/Princ Dx= 574.0 -575.0 (Choly 3)	247	13	14.19	5.66	3	4.90	4.22
Chol 3 w/emergency or urgent adm	106	15.5	16.05	5.40	6.5	6.30	4.11
Choly 3 w/elec. admission	141	11	12.81	5.43	2	3.85	3.98
hosp 101 of Choly 3 w/emergency and urgent	30	16	16.03	4.30	7	6.53	2.63
hosp 103 " " "	27	13	13.90	4.50	4	4.80	4.10
hosp 107 " " "	23	16	16.50	5.12	4	5.23	4.97
hosp 101 Choly 3 w/elec admission	24	10.5	12.88	4.94	2	3.38	2.80
hosp 103 " " "	39	9	11.97	5.44	1	2.92	4.13
hosp 107 " " "	19	11	13.05	4.66	1	3.21	3.17
Choly 3 age 0 - 19	9	11	12.33	3.68	2	3.78	2.78
Choly 3 hosp 101 age 0 - 19	2	15.5	15.5	4.5	6.5	6.5	1.5
Choly 3 hosp 103 age 0 - 19	5	13	12.6	2.33	2	3.8	2.64
Choly 3 hosp 107 age 0 - 19	-	-	-	-	-	-	-
Choly 3 age 20 - 39	61	9	11.03	4.29	1	3.66	3.87
Choly 3 hosp 101 age 20 - 39	12	10	10.75	3.24	2.5	3.58	2.75
Choly 3 hosp 103 age 20 - 39	27	9	10.93	4.28	1	3.0	3.71
Choly 3 hosp 107 age 20 - 39	1	6	6	0	0	0	0

Figure 5

NEW YORK COUNTY HEALTH SERVICES
REVIEW ORGANIZATION

Elaine Remmlinger

Background

Let me first give you some background information about NYCHSRO. We have thirty hospitals and twenty-six of these thirty have been phased-in as of this time. Sixteen are delegated, ten are non-delegated, and four are yet to be phased in. When fully implemented, there will be close to 225,000 discharges. At this point, we have a database available for access of about 116,000 records representing calendar year 1977. This means that anything we do in New York is fairly large scale. In fact, we end up testing the limitations of the AUTOGRP software. So, one might say that we have had quite an experience with AUTOGRP.

We were not part of the original demonstration project, and have had AUTOGRP only since April 1978. Not until the summer of 1978 did we really have any idea of what we were doing. Since then we have become more directed in our analyses as have our committees. They believe that the data we collect are important and they have begun to seriously look at the reports. Before then, no one really knew what to do with the data. Many of our committees were quite skeptical of its reliability. Now the committees have acknowledged that the data are reliable and they are to the point where, after fighting DRGs, they want to use them. So we have come a long way. Our hospitals are becoming more interested in looking at the data with us because we are starting to make some very important decisions based on the data that we have in our system.

The other background I can give you about New York County is that a lot of the decisions we make are much affected by the political climate created by a number of external agencies.

Alcoholism Studies

Alcoholism is the top ranked discharge diagnosis in New York County (Figure 1). It accounts for 6% of the discharges (which is probably an underestimate since this display was based only on five alcohol related DRGs). This finding was shocking to most people. We wanted to know more about alcoholics, so we did some displays to find out the characteristics of these patients (Figure 2). This was very simple. We found out that most of them are single males with an age distribution primarily between 19 and 44. The next largest group is between 45 and 64 years of age. We printed a histogram of LOS which showed a bi-modal distribution with peaks at five and seven day stays (Figure 3).

The questions which then come to mind are: What's happening to these five day stays? Are patients coming in on Monday and going home on Friday and coming back again on Monday? Also, where do they go? So we displayed the discharge status and discovered most of them (84%) are going home, and 14 percent are leaving against medical advice (AMA) (Figure 4). For those who are discharged home, the average length of stay is eight days, so that doesn't answer our question. For those leaving AMA, we found an ALOS of 5 days.

From there we needed to look at patient flow. We hypothesized that LOS might differ in hospitals just with detox programs; as compared to no detox programs; however, the pattern is really the same (Figure 5). For patients with a five day length of stay, we tried to find out when they were admitted. For the most part, admissions are pretty even throughout the week (Figure 6), so that does not answer the question either. And of course these displays generate many other questions. The result of all this is that right now there is an areawide MCE on alcohol justification for detoxification being conducted. We expect to answer more of the questions about this costly social problem.

Cataract Study

A second area I want to present is our experience with cataracts (Figure 7). In 1977, the average length of stay for cataracts was 6.7 days with a median of six (6) days.

Q. Does that include bilaterals?

A. Yes, it does.

Q. What did you do with that?

A. There is an area-wide cataract MCE study. We actually did the same kind of analysis I showed you with the alcohol study. We ran age, and sex distributions, broken down by length of stay groups, and by physician, but really have not come up with too many answers.

Q. Why do you look at marital status?

A. For older single patients, one might think that the length of stay is longer because they live alone.

Other Surgical Procedures and Pre-op Stay

Another one of our problems is illustrated by this display, which is based on the PHDDS reports for January - June 1977 (Figure 8). This display compares the nation, region and New YOrk County on selected procedures. It reveals that in New York County only one procedure has an average pre-op stay less than both the nation and the region. In every other case we exceed both the region and the nation.

Q. Which one is that?

A. Tonsillectomy and Adenoidectomy.

Q. Have you run a study on origin to find out if they are from your area or if they are coming from other areas?

A. Yes. We know that patients are coming in from other areas. Only fifty percent of patients in New York County hospitals are from the county. This was based on a one-day census conducted by Blue Cross in 1975. For a comparable study based on NYCHSRO's own data (federal patients only), the results were essentially the same, although Medicaid patient demonstrate slightly less mobility.

Q. Are you using AUTOGRP to do your MCE's?

A. Yes. We have used AUTOGRP to identify MCE study topics and are presently considering using AUTOGRP to analyze the data for two areawide studies.

PREOP STUDY

We also did a pre-op study to find out which hospitals exceed an areawide preop-norm and for which surgical procedures. We were interested particularly in elective surgical admissions, so the first thing we did was generate a display of patients by admission type. We found that a number of hospitals, in particular hospital 219, had small numbers of elective admissions (Figure 9). To study their elective surgical admissions made little sense. Therefore, we had to combine urgent and elective admissions. We had to do the same thing with hospitals 237, 214 and 211. Consequently, we had a group of elective admissions and a group of elective and urgent admissions combined.

For the group that is just elective, we chose a number of hospitals and displayed their top procedures. This is just an example (Figure 10). Then, we did the same thing for hospitals where elective and urgent admissions had to be combined (Figure 11).

We made a group called "top procedures", (topproc) which includes all the procedures of interest around the county. We had to be sure that we covered every procedure in order to calculate an appropriate areawide norm. Once we did that, we, in this particular case, chose a certain procedure (i.e., masectomy) and displayed it by hospital to get an areawide preoperative norm (Figure 12).

We also found a lot of outliers. We printed out the outliers and found patients with pre-op stays of 268 days and 367 days. We had to correct these date errors (also Figure 12).

Once the analysis was complete, a table for each hospital was prepared. The table displayed surgical procedures for the hospital where their average preop LOS exceeded that for the area (Figure 13). As a result of this analysis a carve out policy is being phased in at all hospitals. Adverse determinations will be rendered for medically unnecessary avoidable days of hospitalization. Phase I of this policy was limited to "pass" days and excessive weekend preoperative stays; however, if the average preop for the hospital exceeded the area norm, fiscal impact was extended to all excessive elective preoperative stays. Phase II to commence on January 15, 1979 will extend this policy to all types of days which were medically unnecessary and avoidable.

This study is still going on. The hospitals are coming in with lots of feedback on the basis of this kind of report. Most of the hospitals were doing an educational carve out program where there was no fiscal impact, but it was mostly to let the physicians know where their problems were. Once the program began to have fiscal impact, hospitals became more interested and are coming in with corrective action plans as well as asking for additional data. They want to share data with us; they want to analyze it with us as they feel this policy will have tremendous impact on the hospital.

Reducing Review Costs With Focused Review

Another area of current study is developing a methodology to reduce review costs (i.e., focus review). Our initial problem was to decide how to triage patients into appropriate review categories (i.e., do you focus out review entirely, just the admission review or should review be intensified?) Initially, we decided to focus out on the basis of the admitting diagnosis appearing on a face sheet. Unfortunately, the face sheet is often inaccurate. So how do you really focus out? Our Hospital Review Division is looking at some of our statistical reports from our data processor trying to determine which diagnoses are within the PAS norm, and have little or no referral activity. For these cases it would seem reasonable to focus out review entirely. This activity will be extended to review on the 50th percentile or intensification of review for problematic diagnoses.

In addition, our Data Division did a study using AUTOGRP. In this example (Figure 14), we displayed the admitting diagnosis, in rank order for this hospital, and found out that normal delivery was the top admitting diagnosis. On our Discharge Diagnosis Report (from our data processor) for that hospital, it was also the top discharge diagnosis. So we knew that this diagnosis warranted further study. We then displayed the discharge diagnoses for those patients that were admitted for normal delivery and found out that 47% were discharged with this same diagnosis (Figure 15).

On the other side, we displayed the admitting diagnosis of the patients discharged with normal delivery and out of the 585 that were discharged with normal delivery, 530 were also admittted for this diagnosis (Figure 16).

The other thing we wanted to do was look at the concurrent review activity. Is there a lot of physician advisor involvement and are patients being denied? So we looked at this and found that on the basis of admitting diagnosis, 98% of them were granted, and only one denial occurred on admission. Seventeen were referred to a physician advisor (also Figure 16). What resulted from this study was the decision to focus out review until the end of the fourth day (i.e., the expiration of the fiftieth percentile).

Q. Does that save the review coordinator any time?

A. Yes. She will only perform 100% concurrent review on cases designated for targeting.

We also did a study based on face sheets to determine the reliability of the Face Sheet admitting diagnosis. Uncomplicated delivery was pretty reliable. We started where we thought it would be the easiest (i.e., obstetrics). In other areas it is going to be more difficult. We know there will be a certain margin or error built into doing any kind of focus review program. Unfortunately, you've got to live with this error in order to reduce the resources used in the review process. At this point we are in the midst of compiling more data. The review people are making focusing decisions based on their own experiences. As you can see, we are approaching the problem in many different ways. We also intend to do physician profiles.

Q. Can you give me some idea of the costs you incur in doing these analyses?

A. It is expensive. Sometimes a project involving a listing of DRGs can come to $75, just for one session. You can do any analysis like this for well over $200. We have really incurred a great deal of expense on AUTOGRP because everything we do is so big. Our physicians and administration are interested in the full year 1977 data (116,000 + cases). Consequently, we have implemented a request form. Anyone who wants to AUTOGRP has to have the request approved by our Executive Director. We have also limited the number of users. One person who has been self taught does most of the AUTOGRPing.

The other thing that we are doing, aside from focus review and our carve out policy is getting lots of requests for data from hospitals and outside agencies.

TOP RANKED DIAGNOSIS GROUPS BY DISCHARGES AND PATIENT DAYS
NEW YORK COUNTY: JANUARY-DECEMBER 1977

		DISCHARGES		PATIENT DAYS	
		NO.	PCT.	NO.	PCT.
1.	Alcoholism	6,814	5.97	64,799	4.24
2.	Drug Dependence	6,220	5.45	71,343	4.67
3.	Cataract Extraction	4,307	3.77	29,761	1.95
4.	GI Cancer	2,698	2.36	65,471	4.28
5.	Normal Delivery	2,627	2.30	11,138	0.73
6.	Abortion	2,609	2.29	3,525	0.23
7.	Ischemic Heart Disease	2,426	1.50	31,795	2.08
8.	Normal Newborn	2,194	1.92	16,279	1.06
9.	Delivery with Complication	1,655	1.45	7,944	0.52
10.	Acute M. I.	1,563	1.37	29,119	1.90
11.	Heart Failure (no operation)	1,549	1.36	22,290	1.46
12.	Schizophrenia	1,404	1.23	30,018	1 96
13.	Venereal Disease	1,139	1.00	8,969	0.58
14.	Other Diseases of Eye	1,070	.92	3,916	0.26
15.	FX of Bone w/surgery	1,055	.90	35,279	2.31
16.	Convulsions	1,026	.90	10,014	0.65
	Total:	40,356	34.73	452,390	28.88

Figure 1

ALCOHOLIC PATIENTS DISPLAYED BY SEX AND MARITAL STATUS: NEW YORK COUNTY: JANUARY-DECEMBER 1977

SEX	COUNT	SINGLE	MARRIED	WIDOWED	DIVORCED	SEPARATED	UNKNOWN
M	4847	3436	304	118	329	562	98
F	693	381	63	61	52	116	20
TOTAL	5540	3817	367	179	381	678	118

ALCOHOLIC PATIENTS DISPLAYED BY SEX AND AGE GROUP NEW YORK COUNTY: JANUARY-DECEMBER 1977

SEX	COUNT	PERCENT	MEAN LOS	AGE UNKNOWN	AGE 0-18	AGE 19-44	AGE 45-64	AGE 65-74	AGE OVER 75
M	4847	87.49%	8.20	2	15	2980	1669	155	26
F	693	12.51%	8.85	2	5	473	163	43	7
TOTAL	5540	100.00%	8.28	4	20	3453	1832	198	33

Figure 2

HISTOGRAM: ALCOHOLIC PATIENTS

NEW YORK COUNTY: JANUARY-DECEMBER 1977

```
 LOS      NO. OBSERVATIONS |
  0        83 **
  1       149 *****
  2       187 ******
  3       219 *******
  4       339 ************
  5      1169 *******************************************
  6       425 ***************
  7      1429 ****************************************************
  8       235 ********
  9       220 *******

 10       145 *****
 11       116 ****
 12        92 ***
 13        84 ***
 14        92 ***
 15        43 *
 16        51 *
 17        54 *
 18        24
 19        46 *

 20        38 *
 21        36 *
 22        31 *
 23        15
 24        28 *
 25        12
 26        10
 27        18
 28        13
 29        14
```

* 0 DAY LOS MEANS PATIENT IS ADMITTED AND DISCHARGED THE SAME DAY.

** 1 DAY LOS MEANS PATIENT STAYED IN THE HOSPITAL OVERNIGHT.

Figure 3

DISPLAY OF ALCOHOLIC PATIENTS BY DISCHARGE STATUS
NEW YORK COUNTY: JANUARY-DECEMBER 1977

NUMBER OBS.	PCT	MEAN LOS	DISCHARGE STATUS
4662	84.15%	8.53	HOME
8	.14%	46.89	SNF
2	.04%	34.00	HRF
1	.02%	13.00	HOME CARE
43	.78%	19.05	OTHER HOSPITAL
779	14.06%	5.38	AGAINST MEDICAL ADVICE
30	.54%	19.47	OTHER INSTITUTION
14	.25%	4.36	DIED

Figure 4

HISTOGRAM: ALCOHOLIC PATIENTS IN DETOX PROGRAMS
NEW YORK COUNTY: JANUARY-DECEMBER 1977

```
LOS    NO. OBSERVATIONS |
 0         50 **
 1         99 ****
 2        114 *****
 3        148 ******
 4        279 ************
 5       1100 *************************************************
 6        370 ****************
 7       1367 ***********************************************************>
 8        159 *******
 9        106 ****

10         63 **
11         52 **
12         49 **
13         51 **
14         58 **
15         24 *
16         37 *
17         39 *
18         19
19         42 *

20         36 *
21         29 *
22         24 *
23         14
24         19
25          8
26          6
27         14
28         13
29          9
```

* 0 DAY LOS MEANS PATIENT IS ADMITTED AND DISCHARGED THE SAME DAY.

** 1 DAY LOS MEAN PATIENT STAYED OVER NIGHT IN THE HOSPITAL.

Figure 5

Patient Flow Analysis

Alcoholic Patients With 5 Day Stay

Display of Day of Admission

New York County: January - December 1977

HOSP	COUNT	PERCENT	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
201	33	2.82%	2	1	1	13	8	8	0
202	1	.09%	0	0	0	0	0	1	0
204	1020	87.25%	66	161	148	175	176	163	131
205	50	4.28%	4	9	10	9	6	7	5
211	8	.68%	0	0	1	1	3	3	0
213	1	.09%	0	0	0	0	0	0	1
220	20	1.71%	2	1	0	5	4	6	2
235	14	1.20%	0	1	2	5	3	3	0
236	5	.43%	0	2	0	0	0	3	0
237	17	1.45%	0	3	2	5	3	3	1
TOTAL	1169	100.00%	74	178	164	213	203	197	140

Figure 6

PROFILE OF CATARACT PATIENTS BY HOSPITAL
NEW YORK COUNTY: JANUARY-DECEMBER 1977

```
  HOSP  0         10        20
       |+---------+---------+---------|     SIZE    MEAN  MEDIAN
    AA |         *-M---*              |       25   13.48   11.00
    BB |     *-M---*                  |       79    8.63    7.00
    CC |    *M-*                      |      145    6.23    5.00
    DD |     *M-*                     |       69    8.29    6.00
    EE |    *-M--*                    |       49    6.84    6.00
    FF |      *-----M--*              |       15   11.00   12.00
    GG |      *---M------*            |       14   12.00    9.50
    HH |     *M---*                   |      413    8.30    6.00
    II |    *M-*                      |     2033    6.34    5.00
    JJ |    *-M--*                    |       51    7.84    6.00
       |                              |
    KK |    *M--*                     |      360    6.44    5.00
    LL |    *M*                       |      127    5.36    5.00
    MM |   *M-*                       |      180    5.20    4.00
    NN |     *M*        M=MEDIAN      |      276    6.43    6.00
    OO |     *M--*                    |       83    7.35    6.00
    PP |      M-*                     |      132    7.86    6.00
    QQ |    *-M-*                     |      253    6.76    6.00
 TOTAL |    *-M-*                     |     4304    6.73    6.00
       |+---------+---------+---------|
        0         10        20
```

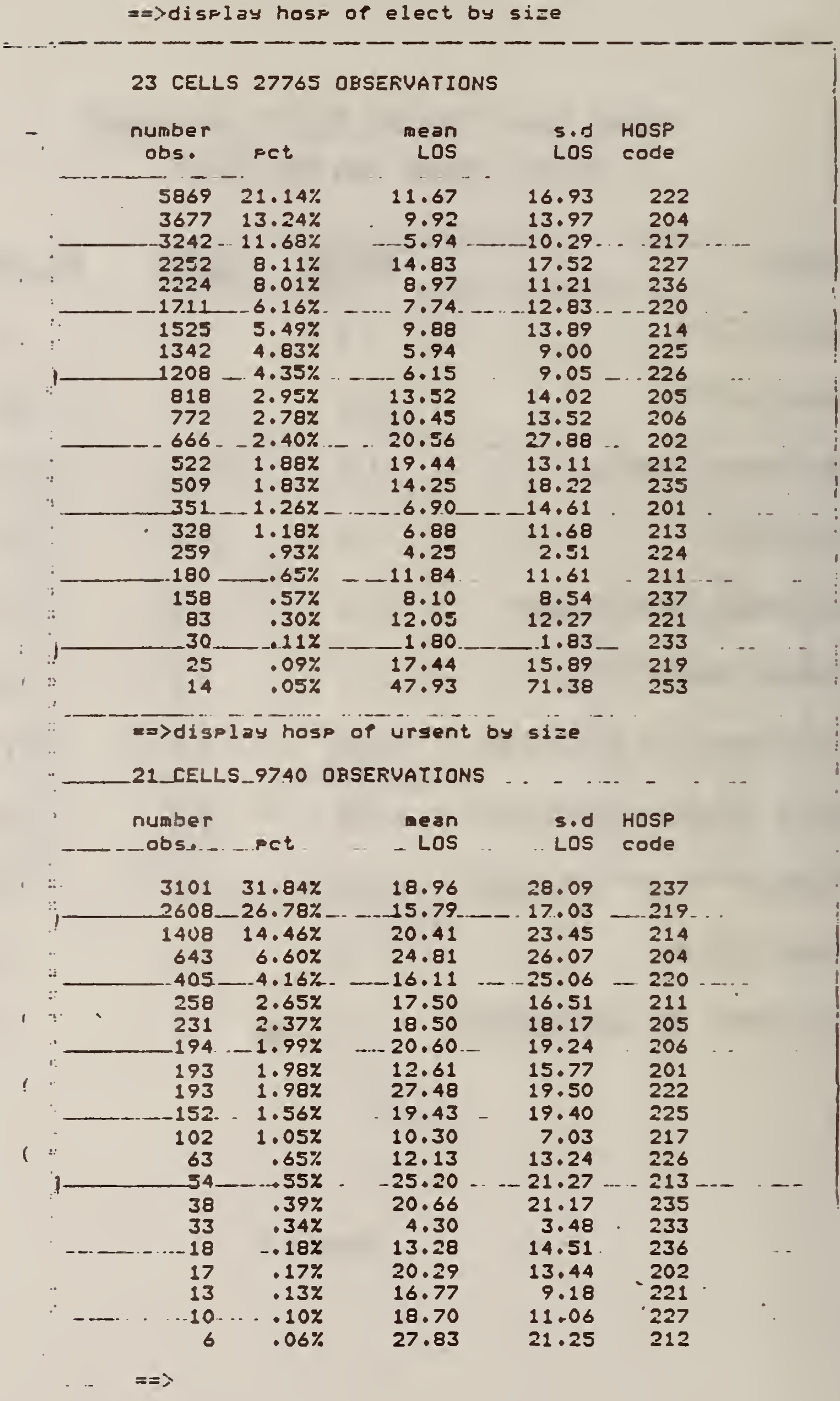
Figure 7

AVERAGE PRE-OP STAY FOR SELECTED PROCEDURES
NATION, REGION, NEW YORK COUNTY

PROCEDURE	NATION	REGION	NEW YORK COUNTY
CHOLECYSTECTOMY	3.8	4.4	5.9
HEMORRHOIDECTOMY	1.9	2.1	2.4
INGUINOFEMORAL HERNIA	1.5	1.7	2.1
HYSTERECTOMY	2.0	2.5	4.0
TRANSURETHRAL PROSTATECTOMY	3.4	4.3	4.7
SUPRAPUBIC PROSTATECTOMY	4.2	4.9	5.1
INTRACAPSULAR LENS EXTRACTION	1.2	1.4	1.6
COMPLETE OR RADICAL MASTECTOMY	2.3	2.7	2.8
ARTHROPLASTY OR HIP REPLACEMENT	2.5	3.1	3.9
CESAREAN SECTION	.9	1.1	2.1
TONSILLECTOMY AND ADENOIDECTOMY	.9	.8	.6

Figure 8

Display of Hospitals by Admit Type
New York County: January - December 1977

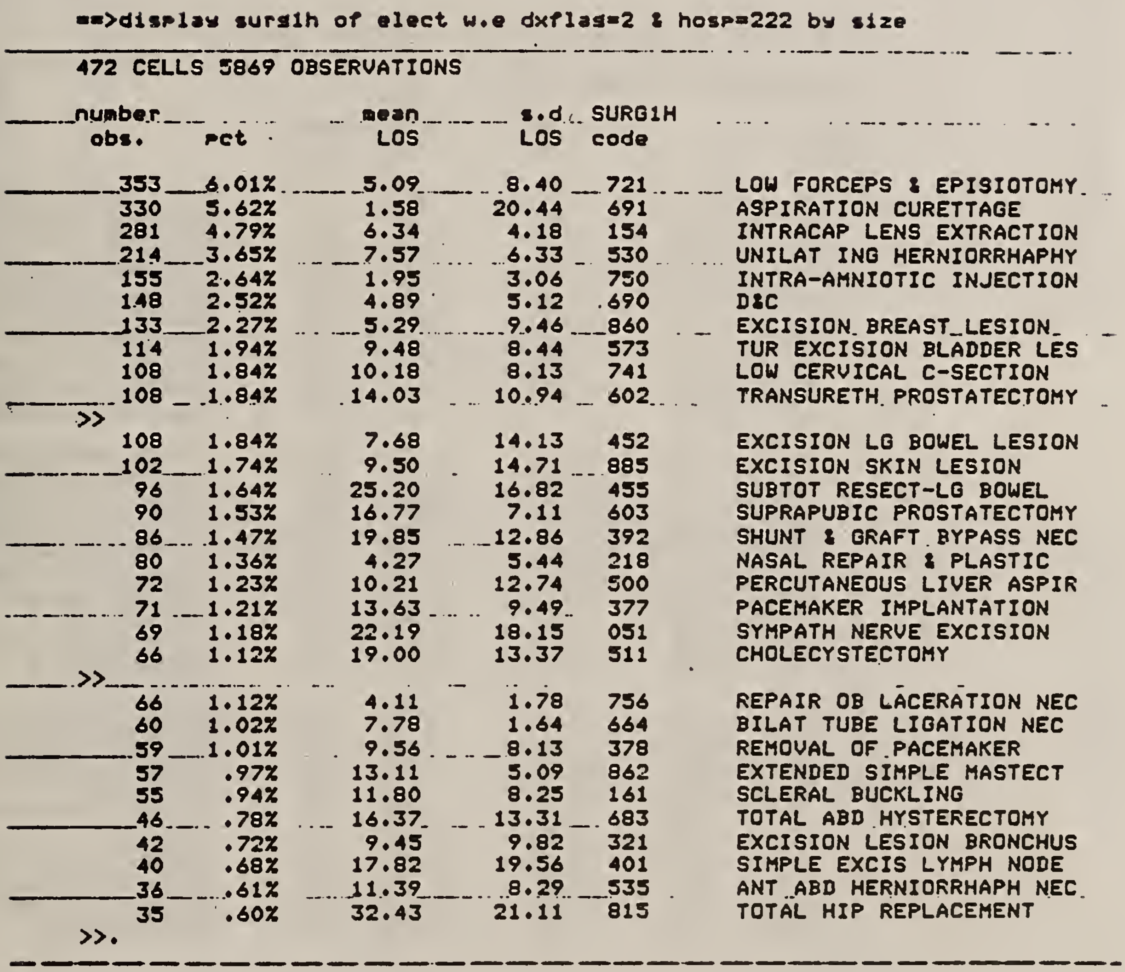


```
==>display hosp of elect by size

 23 CELLS 27765 OBSERVATIONS

 number                     mean          s.d   HOSP
   obs.     pct              LOS          LOS   code

    5869  21.14%           11.67        16.93    222
    3677  13.24%            9.92        13.97    204
    3242  11.68%            5.94        10.29    217
    2252   8.11%           14.83        17.52    227
    2224   8.01%            8.97        11.21    236
    1711   6.16%            7.74        12.83    220
    1525   5.49%            9.88        13.89    214
    1342   4.83%            5.94         9.00    225
    1208   4.35%            6.15         9.05    226
     818   2.95%           13.52        14.02    205
     772   2.78%           10.45        13.52    206
     666   2.40%           20.56        27.88    202
     522   1.88%           19.44        13.11    212
     509   1.83%           14.25        18.22    235
     351   1.26%            6.90        14.61    201
     328   1.18%            6.88        11.68    213
     259    .93%            4.25         2.51    224
     180    .65%           11.84        11.61    211
     158    .57%            8.10         8.54    237
      83    .30%           12.05        12.27    221
      30    .11%            1.80         1.83    233
      25    .09%           17.44        15.89    219
      14    .05%           47.93        71.38    253

 ==>display hosp of urgent by size

 21 CELLS 9740 OBSERVATIONS

 number                     mean          s.d   HOSP
   obs.     pct              LOS          LOS   code

    3101  31.84%           18.96        28.09    237
    2608  26.78%           15.79        17.03    219
    1408  14.46%           20.41        23.45    214
     643   6.60%           24.81        26.07    204
     405   4.16%           16.11        25.06    220
     258   2.65%           17.50        16.51    211
     231   2.37%           18.50        18.17    205
     194   1.99%           20.60        19.24    206
     193   1.98%           12.61        15.77    201
     193   1.98%           27.48        19.50    222
     152   1.56%           19.43        19.40    225
     102   1.05%           10.30         7.03    217
      63    .65%           12.13        13.24    226
      54    .55%           25.20        21.27    213
      38    .39%           20.66        21.17    235
      33    .34%            4.30         3.48    233
      18    .18%           13.28        14.51    236
      17    .17%           20.29        13.44    202
      13    .13%           16.77         9.18    221
      10    .10%           18.70        11.06    227
       6    .06%           27.83        21.25    212

 ==>
```

Figure 9

Display of Principal Surgical Procedure

For Elective Admissions at Hospital 222



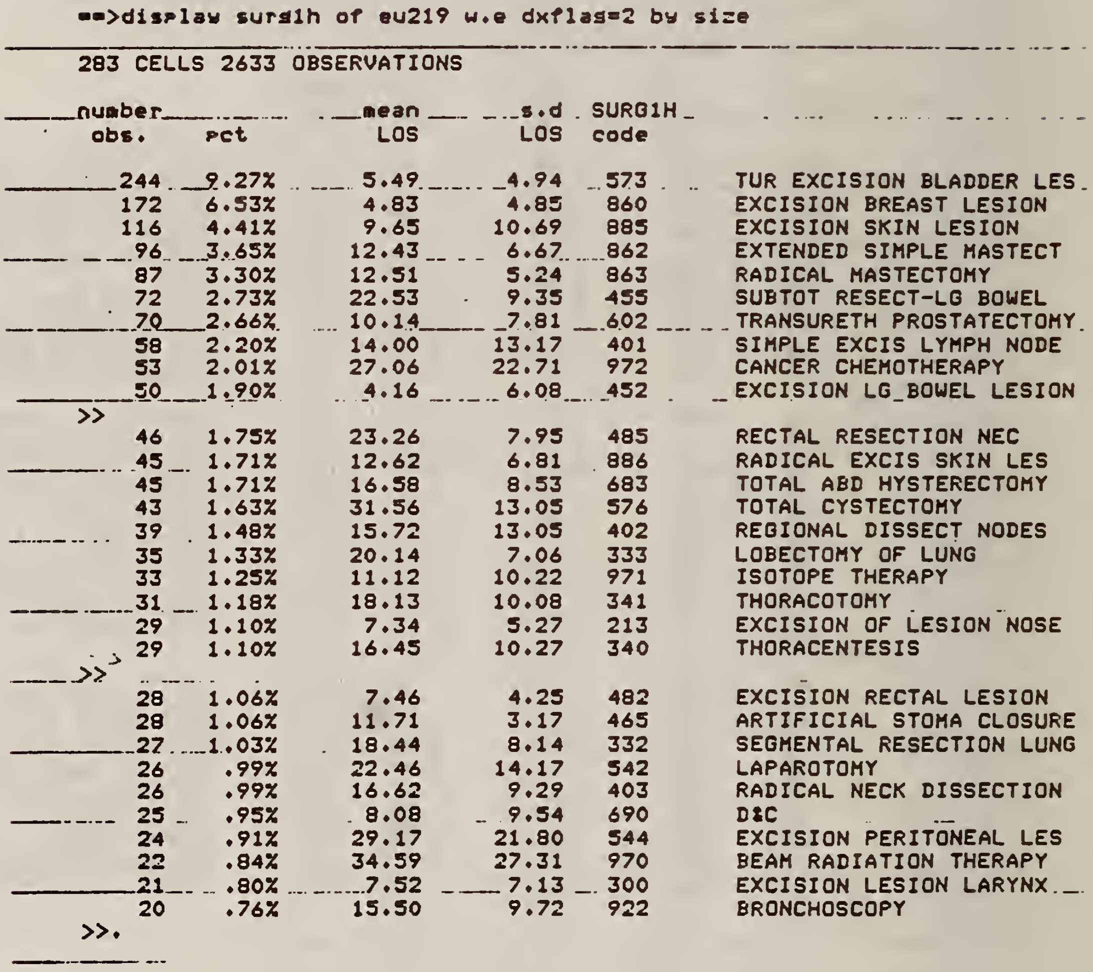
```
==>display surg1h of elect w.e dxflag=2 & hosp=222 by size
------------------------------------------------------------------------------
   472 CELLS 5869 OBSERVATIONS

     number                    mean      s.d.  SURG1H
      obs.      pct             LOS      LOS   code

          353   6.01%          5.09     8.40   721      LOW FORCEPS & EPISIOTOMY
          330   5.62%          1.58    20.44   691      ASPIRATION CURETTAGE
          281   4.79%          6.34     4.18   154      INTRACAP LENS EXTRACTION
          214   3.65%          7.57     6.33   530      UNILAT ING HERNIORRHAPHY
          155   2.64%          1.95     3.06   750      INTRA-AMNIOTIC INJECTION
          148   2.52%          4.89     5.12   690      D&C
          133   2.27%          5.29     9.46   860      EXCISION BREAST LESION
          114   1.94%          9.48     8.44   573      TUR EXCISION BLADDER LES
          108   1.84%         10.18     8.13   741      LOW CERVICAL C-SECTION
          108   1.84%         14.03    10.94   602      TRANSURETH PROSTATECTOMY
   >>
          108   1.84%          7.68    14.13   452      EXCISION LG BOWEL LESION
          102   1.74%          9.50    14.71   885      EXCISION SKIN LESION
           96   1.64%         25.20    16.82   455      SUBTOT RESECT-LG BOWEL
           90   1.53%         16.77     7.11   603      SUPRAPUBIC PROSTATECTOMY
           86   1.47%         19.85    12.86   392      SHUNT & GRAFT BYPASS NEC
           80   1.36%          4.27     5.44   218      NASAL REPAIR & PLASTIC
           72   1.23%         10.21    12.74   500      PERCUTANEOUS LIVER ASPIR
           71   1.21%         13.63     9.49   377      PACEMAKER IMPLANTATION
           69   1.18%         22.19    18.15   051      SYMPATH NERVE EXCISION
           66   1.12%         19.00    13.37   511      CHOLECYSTECTOMY
   >>
           66   1.12%          4.11     1.78   756      REPAIR OB LACERATION NEC
           60   1.02%          7.78     1.64   664      BILAT TUBE LIGATION NEC
           59   1.01%          9.56     8.13   378      REMOVAL OF PACEMAKER
           57    .97%         13.11     5.09   862      EXTENDED SIMPLE MASTECT
           55    .94%         11.80     8.25   161      SCLERAL BUCKLING
           46    .78%         16.37    13.31   683      TOTAL ABD HYSTERECTOMY
           42    .72%          9.45     9.82   321      EXCISION LESION BRONCHUS
           40    .68%         17.82    19.56   401      SIMPLE EXCIS LYMPH NODE
           36    .61%         11.39     8.29   535      ANT ABD HERNIORRHAPH NEC
           35    .60%         32.43    21.11   815      TOTAL HIP REPLACEMENT
   >>.
------------------------------------------------------------------------------
```

Figure 10

Display of Principal Surgical Procedures

for Elective and Urgent Admissions (combined)

at Hospital (219)



```
==>display surg1h of eu219 w.e dxflag=2 by size
------------------------------------------------------------------------
283 CELLS 2633 OBSERVATIONS

    number             mean        s.d   SURG1H
  obs.      pct         LOS        LOS   code

     244   9.27%       5.49       4.94   573      TUR EXCISION BLADDER LES
     172   6.53%       4.83       4.85   860      EXCISION BREAST LESION
     116   4.41%       9.65      10.69   885      EXCISION SKIN LESION
      96   3.65%      12.43       6.67   862      EXTENDED SIMPLE MASTECT
      87   3.30%      12.51       5.24   863      RADICAL MASTECTOMY
      72   2.73%      22.53       9.35   455      SUBTOT RESECT-LG BOWEL
      70   2.66%      10.14       7.81   602      TRANSURETH PROSTATECTOMY
      58   2.20%      14.00      13.17   401      SIMPLE EXCIS LYMPH NODE
      53   2.01%      27.06      22.71   972      CANCER CHEMOTHERAPY
      50   1.90%       4.16       6.08   452      EXCISION LG BOWEL LESION
>>
      46   1.75%      23.26       7.95   485      RECTAL RESECTION NEC
      45   1.71%      12.62       6.81   886      RADICAL EXCIS SKIN LES
      45   1.71%      16.58       8.53   683      TOTAL ABD HYSTERECTOMY
      43   1.63%      31.56      13.05   576      TOTAL CYSTECTOMY
      39   1.48%      15.72      13.05   402      REGIONAL DISSECT NODES
      35   1.33%      20.14       7.06   333      LOBECTOMY OF LUNG
      33   1.25%      11.12      10.22   971      ISOTOPE THERAPY
      31   1.18%      18.13      10.08   341      THORACOTOMY
      29   1.10%       7.34       5.27   213      EXCISION OF LESION NOSE
      29   1.10%      16.45      10.27   340      THORACENTESIS
>>
      28   1.06%       7.46       4.25   482      EXCISION RECTAL LESION
      28   1.06%      11.71       3.17   465      ARTIFICIAL STOMA CLOSURE
      27   1.03%      18.44       8.14   332      SEGMENTAL RESECTION LUNG
      26    .99%      22.46      14.17   542      LAPAROTOMY
      26    .99%      16.62       9.29   403      RADICAL NECK DISSECTION
      25    .95%       8.08       9.54   690      D&C
      24    .91%      29.17      21.80   544      EXCISION PERITONEAL LES
      22    .84%      34.59      27.31   970      BEAM RADIATION THERAPY
      21    .80%       7.52       7.13   300      EXCISION LESION LARYNX
      20    .76%      15.50       9.72   922      BRONCHOSCOPY
>>.
```

Figure 11

Display of Mastectomy Cases by Hospital

New York County: 1977

```
=>profile topproc w.e ('surg1 654,655,656' & dxflag=1) | ('surg1h 862,863,864' & !
=>dxflag=2) using hosp

   HOSP  0         10        20        30
        !+---------+---------+---------+---------!      SIZE     MEAN      S.D.   MEDIAN
    201 !  M                                     !         1     2.00       .00     2.00
    202 ! *M*                                    !         7     2.86      3.24     2.00
    204 ! *M                                     !        20     1.95      1.32     2.00
    205 ! *M---*                                 !         9     3.44      3.13     2.00
    206 ! M*                                     !        38     1.79      1.42     1.00
    211 !  *M-*                                  !         2     3.50      2.12     3.50
    214 ! *M*                                    !        44     2.80      2.77     2.00
    219 !  M*                                    !       186     6.58     37.78     2.00
    220 ! *-------M----------------------*       !         3    13.67     15.53     9.00
    221 !  M                                     !         1     2.00       .00     2.00
    222 ! M*                                     !        76     2.05      2.10     1.00
    225 ! M-*                                    !        16     2.75      3.49     1.00
    226 !  M-                                    !         7     2.00       .58     2.00
    227 !   *-M*                                 !        20     4.70      2.34     5.00
    235 ! M---*                                  !         6     2.83      2.79     1.50
    236 ! *M                                     !        11     2.27      2.10     2.00
    237 ! *M--*                                  !        27     3.30      3.20     2.00
  TOTAL ! *M*                                    !       474     4.21     23.82     2.00
        !+---------+---------+---------+---------!
         0         10        20        30

EOF IS DEFINED FROM 0 TO 500 BY 1
```

Display Outliers

```
rint bchnum,recnum,mrecnum,amon,aday,ayr,smon,sday,syr,adxh,ddx1h,prei@op,los,!
otday,surg2h,surg3h,surg4h of h219 w.e ('surg1h 862,863,864' & dxflag=2) & preop>10

BCHNUM RECNUM   MRECNU!AMON    ADAY     AYR    SMON    SDAY     SYR ADXH    DDX1H    PREOP

207     1007528 726956     3      13      77       3      25      77 7079    1740        12
281     1083162 641966     7      31      77       8       3      78 1740    1740       368
271     1083096 640628     5      10      77       5      26      77 6100    1740        16
248     1032246 732882    12       5      77      12       7      78 1740    1740       367
212     1022163 730770     8      29      77       9       9      77 1740    1740        11
204     0104220 629643     7      29      77       8      10      77 2022    2000        12
=>
```

```
LOS TOTDAY SURG2H SURG3H SURG4H

 60     59 344    893    860
 15     15 860
 25     30 683    655    860
 11     13 870
 19     31 311    860    989
 19     31 860    870    967
```

Figure 12

NEW YORK COUNTY HEALTH SERVICES REVIEW ORGANIZATION

Analysis of Preoperative Length of Stay for Patients Under NYCHSRO Purview
Undergoing Selected Surgical Procedures in Calendar Year 1977

Procedure	This Hospital Number of Cases	This Hospital Mean Preop Days	Areawide Mean Preop. Days
All Surgical Cases	3,341	3.98	4.38
1. Low or outlet forceps delivery with episiotomy and episiotomy NEC	402	1.31	0.83
2. Dilation and curettage	397	.83	.70
3. Extraction of lens, intracapsular or extracapsular	138	1.61	1.42
4. Low cervical cesarean section	107	3.58	2.23
5. Excision of lesion or tissue of breast	75	2.47	2.08
6. Intra-amniotic injection	64	.72	.49
7. Local excision of lesion of skin and subcutaneous tissue	56	3.41	2.98
8. Circumcision	27	3.93	2.31
9. Resection and/or advancement or recession of ocular muscle and tendon	20	1.15	1.02
10. Other anterial shunt or graft bypass	19	8.68	6.65
11. Bilateral tubal ligation, NEC	18	2.67	1.26
12. Conization, amputation, and other excision or destruction of lesion or tissue of cervix	18	2.17	2.15

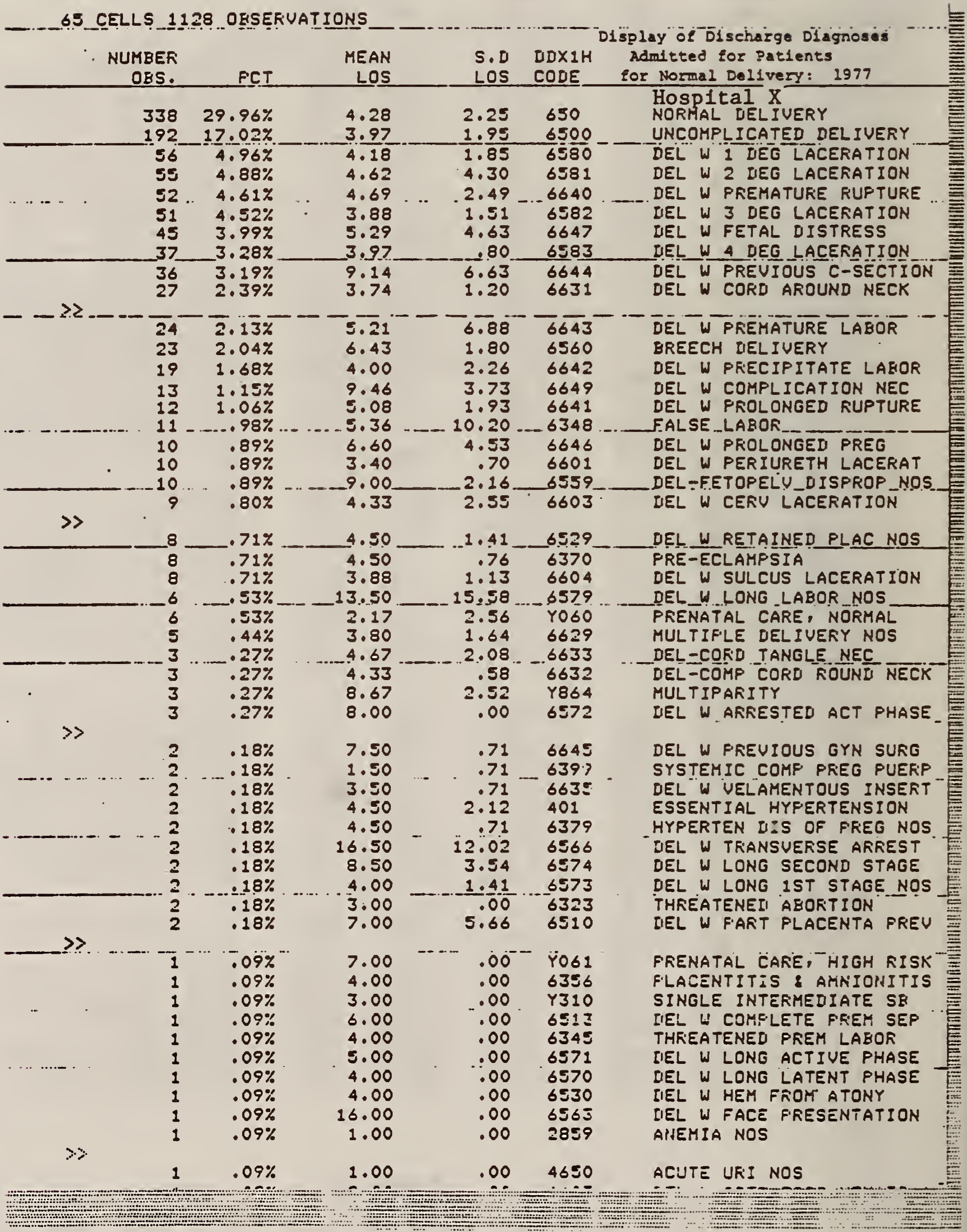
Figure 13

Display of Top Admitting Diagnoses

Hospital X: 1977

```
==>.df adxh with 1500 values
==>display adxh of * by size

 1501 CELLS 15662 OBSERVATIONS

          NUMBER              MEAN        S.D  ADXH
            OBS.     PCT       LOS        LOS  CODE

             20     .13%     11.10      16.79  OUT-OF-BOUNDS
            687    4.39%      5.01       4.24   650        NORMAL DELIVERY
            660    4.21%      6.68       7.42   Y200       SINGLE TERM HOSP NB-SPON
            441    2.82%      4.45       3.38   6500       UNCOMPLICATED DELIVERY
            390    2.49%      6.08      17.12   4939       MIXED ASTHMA & NOS
            390    2.49%     10.58      10.89   7703       CONVULSIONS
            341    2.18%       .27        .85   641        THERAPEUTIC ABORTION NEC
            300    1.92%     13.18      15.54   2500       DIAB MEL ADULT ONSET NOS
            236    1.51%     14.14       9.19   3149       DEPENDENCE NOS
            234    1.49%     12.81      11.36   4279       CONGESTIVE HEART FAILURE
            211    1.35%     11.65      15.31   486        PNEUMONIA NOS
 >>
            211    1.35%     19.41      24.24   3068       SCHIZOPHRENIA-TYPE NEC
            205    1.31%     16.23      10.40   3063       PARANOID SCHIZOPHRENIA
            172    1.10%     14.75      16.85   3105       DEPRESSIVE NEUROSIS
            147     .94%     16.37      13.58   3069       SCHIZOPHRENIA NOS
            143     .91%      4.69       8.89   8500       CONCUSSION CURRENT
            138     .88%      6.93       8.65   5400       ACUTE APPENDICITIS NOS
            136     .87%      9.38       7.35   5770       ACUTE PANCREATITIS
            131     .84%      8.12       7.37   0092       GASTROENTERITIS, COLITIS
            128     .82%      4.92       2.07   6640       DEL W PREMATURE RUPTURE
            127     .81%      9.20       4.45   Y203       SINGLE TERM HOSP NB-CS
 >>
            118     .75%     10.86       9.27   4109       MYOCARD INFARCTION NOS
            115     .73%     13.59      13.99   7815       HEMATEMESIS
            114     .73%      9.96      11.42   4810       LOBAR PNEUMONIA
            111     .71%      5.64       6.03   9779       ADV EFF DRUG NOS
            110     .70%       .06        .34   6410       THERAPEUTIC ABORTION NEC
            108     .69%      1.72        .87   6431       INCOMPLETE SPON ABORTION
            101     .64%      9.57       8.68   2507       CHEM DIABETES MELLITUS
             99     .63%      4.87       6.26   8540       INTRACRANIAL INJURY NEC
             97     .62%     11.38      12.96   3132       ALCOHOLIC ADDICTION
             87     .56%      9.25      11.90   4860       PNEUMONIA NOS
 >>
             85     .54%     15.87      13.23   5710       LAENNEC'S CIRRHOSIS
             84     .54%     12.01      13.51   7800       ABDOMINAL PAIN
             82     .52%     16.37      14.89   7902       DEHYDRATION NEC
             82     .52%     12.05       9.17   5609       INTESTIN OBSTRUCTION NOS
             81     .52%     15.62       9.34   3064       AC SCHIZOPHRENIC EPISODE
             80     .51%     10.21      16.89   5852       CHRONIC RENAL FAILURE
             79     .50%     20.24      22.01   Y210       SINGLE PREM HOSP NB-SPON
             79     .50%      9.63      11.88   401        ESSENTIAL HYPERTENSION
             78     .50%     13.31      11.04   5750       ACUTE CHOLECYSTITIS
             75     .48%     12.73      42.30   4891       ACUTE BRONCHIOLITIS
 >>
             73     .47%     12.90      10.85   4129       CHR ISCHEMIC HRT DIS NEC
             72     .46%     17.10      13.59   3049       AC BRAIN SYN & DIS NEC
             72     .46%     20.03      19.67   3094       PSYCHOSIS NEC
             71     .45%     13.55       5.99   3140       DEPENDENCE ON OPIUM
             69     .44%     12.72      18.03   5995       URIN TRACT INFECTION NOS
             64     .41%      8.17       7.55   5500       UNILAT INGUINAL HERNIA
             63     .40%     13.37      11.65   7820       GI BLEEDING NEC
             62     .40%      7.21      13.91   Y201       SINGLE TERM HOSP NB-LF
             58     .37%     27.72      25.21   4360       CVA WITHOUT PARALYSIS
             55     .35%     32.35      26.56   4361       CVA WITH PARALYSIS
 >>
```

Figure 14



```
    65 CELLS 1128 OBSERVATIONS
                                                         Display of Discharge Diagnoses
   NUMBER                  MEAN        S.D   DDX1H     Admitted for Patients
     OBS.      PCT          LOS        LOS   CODE     for Normal Delivery:  1977
                                                        Hospital X
      338   29.96%         4.28       2.25   650        NORMAL DELIVERY
      192   17.02%         3.97       1.95   6500       UNCOMPLICATED DELIVERY
       56    4.96%         4.18       1.85   6580       DEL W 1 DEG LACERATION
       55    4.88%         4.62       4.30   6581       DEL W 2 DEG LACERATION
       52    4.61%         4.69       2.49   6640       DEL W PREMATURE RUPTURE
       51    4.52%         3.88       1.51   6582       DEL W 3 DEG LACERATION
       45    3.99%         5.29       4.63   6647       DEL W FETAL DISTRESS
       37    3.28%         3.97        .80   6583       DEL W 4 DEG LACERATION
       36    3.19%         9.14       6.63   6644       DEL W PREVIOUS C-SECTION
       27    2.39%         3.74       1.20   6631       DEL W CORD AROUND NECK
 >>
       24    2.13%         5.21       6.88   6643       DEL W PREMATURE LABOR
       23    2.04%         6.43       1.80   6560       BREECH DELIVERY
       19    1.68%         4.00       2.26   6642       DEL W PRECIPITATE LABOR
       13    1.15%         9.46       3.73   6649       DEL W COMPLICATION NEC
       12    1.06%         5.08       1.93   6641       DEL W PROLONGED RUPTURE
       11     .98%         5.36      10.20   6348       FALSE LABOR
       10     .89%         6.60       4.53   6646       DEL W PROLONGED PREG
       10     .89%         3.40        .70   6601       DEL W PERIURETH LACERAT
       10     .89%         9.00       2.16   6559       DEL-FETOPELV DISPROP NOS
        9     .80%         4.33       2.55   6603       DEL W CERV LACERATION
 >>
        8     .71%         4.50       1.41   6529       DEL W RETAINED PLAC NOS
        8     .71%         4.50        .76   6370       PRE-ECLAMPSIA
        8     .71%         3.88       1.13   6604       DEL W SULCUS LACERATION
        6     .53%        13.50      15.58   6579       DEL W LONG LABOR NOS
        6     .53%         2.17       2.56   Y060       PRENATAL CARE, NORMAL
        5     .44%         3.80       1.64   6629       MULTIPLE DELIVERY NOS
        3     .27%         4.67       2.08   6633       DEL-CORD TANGLE NEC
        3     .27%         4.33        .58   6632       DEL-COMP CORD ROUND NECK
        3     .27%         8.67       2.52   Y864       MULTIPARITY
        3     .27%         8.00        .00   6572       DEL W ARRESTED ACT PHASE
 >>
        2     .18%         7.50        .71   6645       DEL W PREVIOUS GYN SURG
        2     .18%         1.50        .71   6397       SYSTEMIC COMP PREG PUERP
        2     .18%         3.50        .71   6635       DEL W VELAMENTOUS INSERT
        2     .18%         4.50       2.12   401        ESSENTIAL HYPERTENSION
        2     .18%         4.50        .71   6379       HYPERTEN DIS OF PREG NOS
        2     .18%        16.50      12.02   6566       DEL W TRANSVERSE ARREST
        2     .18%         8.50       3.54   6574       DEL W LONG SECOND STAGE
        2     .18%         4.00       1.41   6573       DEL W LONG 1ST STAGE NOS
        2     .18%         3.00        .00   6323       THREATENED ABORTION
        2     .18%         7.00       5.66   6510       DEL W PART PLACENTA PREV
 >>
        1     .09%         7.00        .00   Y061       PRENATAL CARE, HIGH RISK
        1     .09%         4.00        .00   6356       PLACENTITIS & AMNIONITIS
        1     .09%         3.00        .00   Y310       SINGLE INTERMEDIATE SB
        1     .09%         6.00        .00   6513       DEL W COMPLETE PREM SEP
        1     .09%         4.00        .00   6345       THREATENED PREM LABOR
        1     .09%         5.00        .00   6571       DEL W LONG ACTIVE PHASE
        1     .09%         4.00        .00   6570       DEL W LONG LATENT PHASE
        1     .09%         4.00        .00   6530       DEL W HEM FROM ATONY
        1     .09%        16.00        .00   6563       DEL W FACE PRESENTATION
        1     .09%         1.00        .00   2859       ANEMIA NOS
 >>
        1     .09%         1.00        .00   4650       ACUTE URI NOS
```

Figure 15

Display of Admitting Diagnoses
for Patients Discharged
with Normal Delivery
Hospital X:1977

```
display adxh of * w.e 'ddx1h 6500,650' by size

17 CELLS 585 OBSERVATIONS

         NUMBER                 MEAN        S.D   ADXH
          OBS.      PCT         .LOS        LOS   CODE

          338   57.78%          4.28        2.25   650     NORMAL DELIVERY
          192   32.82%          3.97        1.95   6500    UNCOMPLICATED DELIVERY
           21    3.59%          4.33        1.85   6640    DEL W PREMATURE RUPTURE
           10    1.71%         13.30        7.47   2507    CHEM DIABETES MELLITUS
            6    1.03%          9.33        4.63   6370    PRE-ECLAMPSIA
            4     .68%         13.25        5.19   2500    DIAB MEL ADULT ONSET NOS
            3     .51%          4.67         .58   6643    DEL W PREMATURE LABOR
            2     .34%          8.50        6.36   6378    HYPERTEN DIS OF PREG NEC
            1     .17%         24.00         .00   3949    NONRHEUM MITRAL DISEASE
            1     .17%          9.00         .00   6379    HYPERTEN DIS OF PREG NOS
>>
            1     .17%          5.00         .00   6644    DEL W PREVIOUS C-SECTION
            1     .17%         10.00         .00   6641    DEL W PROLONGED RUPTURE
            1     .17%          4.00         .00   6344    PREMATURE RUPTURE NO DEL
            1     .17%          7.00         .00   6349    COMPLICATION PREG NEC
            1     .17%          3.00         .00   6510    DEL W PART PLACENTA PREV
            1     .17%         11.00         .00   6646    DEL W PROLONGED PREG
            1     .17%         15.00         .00   3911    ACT RHEUMATIC ENDOCARD
```

```
==>display aproc,alevl of * w.e 'adxh 650,6500'          Hospital X

3 CELLS 1128 OBSERVATIONS                                Display of Admission
                                                         Certification Activity
    NUMBER                MEAN          S.D  APROC       for Patients Admitted
     OBS.      PCT         LOS          LOS  CODE        For Normal Delivery:  1977

     1107   98.14%         4.85         3.95      2 CONGRT Concurrent Granted
        1     .09%         2.00          .00      3 CONDEN Concurrent Denied
       20    1.77%         1.90         1.17      4 NOTPERF Not Performed.
```

```
3 CELLS 1128 OBSERVATIONS                                Hospital X

    NUMBER                MEAN          S.D  ALEVL   Display of Admission Review
     OBS.      PCT         LOS          LOS  CODE    level for Patients Admitted
                                                     for Normal Delivery:  1977
       20    1.77%         1.90         1.17 OUT-OF-BOUNDS
     1091   96.72%         4.73         3.72      1 REVCOOR Review Coordinator
       17    1.51%        12.29         8.79      2 PA       Physician Advisor
```

Figure 16

5.0 CONCLUSION

While the experience of the project PSRO's as reported here demonstrates convincingly the value of the system as an aid in attaining PSRO objectives, we find the management of the data processing and analysis activity to present different problems from those encountered without AUTOGRP. The fundamental problem is that AUTOGRP is first a formal system for retrieval and analysis of data, second it is a rich system in terms of the diversity of alternatives presente to the user, and third, it is relatively easy to learn to use commands but more difficult to learn to use them efficiently. In order to control data analysis activities, it is going to be essential that each PSRO using AUTOGRP have a formal control system which can guide each user in his interaction with data as he deals with any particular problem. Ease of learning is deceptive in that a little knowledge gives one power over data, but usually at much higher cost than might be experienced with greater knowledge and skill.

The appropriate management strategy based on our experience would seem to involve two basic ingredients, training and operating procedures. In the first place, it is important for each potential user to undergo a reasonably rigorous training program which involves hands on experience with a variety of problems typical of PSRO interests. This initial training of about one week in duration should be reinforced with at least one 2-3 day follow up training session after the trainee has had perhaps 4-6 weeks of experience on the job. We have observed a number of instances in which users developed poor (and costly) habits in the use of AUTOGRP which could easily have been corrected with appropriate formal followup.

In guiding day to day use of AUTOGRP at the PSRO, there should be a formal log of every session stating its purpose, time required, data accessed, cost, and identifying the user. Printout of the session should be filed and periodically (probably weekly) the manager should review each session so as to identify practice which needs attention.

Guidelines for system use should be established which indicate the constraints on system use to be observed by users. Size of data base accessed, length of session, and cost of session should all be dealt with. Every user should know when he needs to go to the manager before initiating or proceeding with any session. While it is true that much value derives from the ease with which one can use the system, it is also easy to abuse the responsibility placed on each user. For example, no user should ever bring down 50,000 records at one time if he is going to use subsets of these records independently. He should divide his requests for on line data so as to trade off initial setup costs with online operating costs. Experience helps in making such decisions, but general guidelines should be established by each PSRO.

The utility of batch reports in reducing interactive costs should be assessed by each data manager. Further, using AUTOGRP's "search-order-report" capability, special reports can be coded as a set of commands, stored in user files, and then executed by a single command from the user's terminal as new data becomes available.

It is our observation that AUTOGRP can play a major role in focusing PSRO effort in those areas in which there are known problems and in which there is significant potential for impact. An important ingredient of the system's use would be a monitoring system which would track specific problem areas by defining the kinds of episodes (diagnoses, procedures, ages, providers, and the like) which are likely to generate problems. Then as records are acquired in these areas, the system could be instructed to compute values of critical variables, compare these to pre-defined criteria, and report significant changes. In this way retrospective data could guide the PSRO to more effective concurrent review. Of course, a necessary condition to such control is timely entry of discharge data.

We believe that the experience reported here demonstrates conclusively the effectiveness of AUTOGRP in the PSRO setting. But it is clear that the power of AUTOGRP carries with it a responsibility to control carefully its use so that this use is efficient. The data manager in an AUTOGRP PSRO must be aware of the power as well as the costs and thus must be as capable a user as anyone in the PSRO. It seems clear that this is the primary condition for success in use of the system.

PART II

Mini-Computer Based System

The original motivation and design for a mini-computer based system came as a result of our interaction with the sites under the previous contract. At that time, the PSROs indicated that in order to perform effectively their functions with regard to concurrent review, profile analysis, and MCE studies, it was essential to have an information system that provided timely and accurate data with the capability for flexible retrieval and display. It was felt by some of the PSROs that this could be achieved, at reasonable costs with a mini-computer located on site. Moreover, in this respect it offered the further advantage of increased security for the data was always under the complete control of the PSRO.

In order to be operable in a PSRO setting which may not have personnel with extensive experience in computers, it was recognized in the early stages of design that utilization of the software and hardware must be understandable to non-programmers. Thus, routine operations and special capabilities had to be executable by various levels of staff. The particular hardware chosen to use was the PDP 11 series available through Digital Equipment Corporation (DEC). This line comes in a wide range of computers in terms of size and speed, which are also upwardly compatible.

With a multiuser operating system in order to support several data entry operations, file inquiry, and other tasks a complete data entry/edit system could be built. Thus, a PSRO, with the proper hardware, could have all or part of the following capabilities under its control:

1. on site data entry including editing, validity checks, and error corrections at the time of entry,
2. on line storage,

3. tape creation to produce quarterly required PHDDS tapes and to provide system backup,
4. hard copy printout for required and requested reports,
5. AUTOGRP for data analysis.

Under this contract, a mini data entry system was developed and implemented with extensive features for field and cross field checks and data edits. In addition, certain variables such as age and los can be calculated automatically from dates and displayed for verification purposes. Similarly, English descriptions of HICDA2 and ICDA8 codes, providers and physicians can be displayed for verification. Records created by the system can be accessed fro both inquiry and update. An overview of the data entry system is presented in the following sections.

Data Entry System Overview

The Data Entry System provides for the generation, inspection, and alteration of structured databases, under the control of files created by the user. Because it is the user who creates the files used to generate, inspect, and alter databases, each implementation of the Data Entry System can be designed to meet user-specific needs and can also be modified by the user, as necessary. For example, the data entry forms through which data is entered can be specially designed, and may be revised and updated from time to time. Also, special edit checks can be programmed into the system so that data entered at the terminal is checked for validity before being stored in the database.

The tasks that must be performed by the user in order to take advantage of the flexibility of the data Entry System can be split into two broad categories: 1) the design, implementation, and management of a particular version of the Data Entry System, and 2) the entry, review, and editing of data once that version has been implemented. Very often, the "user" is actually two or more people, each of whom contributes to the performance of the tasks in these two categories. The term "data manager" will be used to identify the person or persons responsible for the first set of tasks, and the term "data entry operator," or simply "operator," will be used to identify the person or persons responsible for the second set of tasks.

The set of tasks to be performed by the data manager can itself be split into two categories: 1) the definition and management of the database used to store data entered by the data entry operator, and 2) the definition of the data entry process, including both the description of the forms which the data entry operator will fill in on the terminal screen, and the specification of the edit checks to be performed on the data which is actually entered. Associated with each of these two task categories, as well as with the data entry operator's task category, is a highly specialized system language designed to carry out just those tasks which fall within each category. The Data Base Definition Language (DBDL) is used by the data manager to define the structure of the database, the Data Entry Definition Language (DEDL) is used by the data manager to define the data entry process, and the Data Entry Control Language (DECL) is used by the data entry operator to control the entry, review and editing of data.

Database Definition

As indicated above, the first of the two sets of tasks which the data manager must perform is the definition of the database, so that the system will know where and how to store the data entered by the data entry operator while filling in forms at the terminal. The first task is to define a database structure that adequately reflects the user's own needs and desires for a particular implementation of the Data Entry System. Once a database design has been developed, the data manager communicates the design to the system by means of a special file called the Variable Definition File (VDF). The VDF contains statements taken from the Data Base Definition Language (DBDL), and describes the entire structure of the database.

Once the BDF has been created, it is compiled into a machine readable version, which is used as input to a system program called DBINIT (Data Base Initialization). The output is the database itself with all files appropriately initialized.

Data Entry Definition

The first step in the data manager's second task of data entry definition is the creation of a data entry control file. This file contains statements in the Data Entry Definition Language (DEDL) that describe the form layouts and specify the error checks that are to be made on the data. Once this file has been constructed it is used, along with the compiled version of the VDF, as input to the DEDL compiler. The output from the compiler is a machine readable version of the control file. The compiled data entry control file is not actually used until the data entry operator begins interacting with the database by entering data at the terminal.

Data Entry Control

Once both the database and the data entry process have been well defined for a particular Data Entry System implementation, data entry may begin. The data entry operator may ask the system to display empty forms on the screen so that they may be filled in, to store the data entered in those forms in the database, or to retrieve previously entered data from the database so that it may be reviewed and/or edited, as necessary. To accomplish these tasks, the operator must enter commands taken from the Data Entry Control Language

(DECL). These commands make use of the information stored in the compiled versions of the data entry control file and the variable definition file, created by the data manager, to locate and display empty frames, store data, or retrieve previously entered data.

The process of data entry, review, and editing goes on for as long as the operator continues to enter the appropriate DECL commands. New observations are added to the database and old observations are retrieved for review and editing at the operator's command. Intervention from the data manager will only need to take place as datasets within the database become full or particular problems arise which cannot be solved by the data entry operator.

Installation of Mini-Computer Systems at South Carolina and Pasadena

The issues which arise and the evaluations desired from this phase of the experiment included the following:

1. Can a minicomputer be programmed to provide all of the data processing needs for a PSRO?
2. How large must a PSRO be to be able to cover, with a per-discharge processing budget, the many fixed costs associated with minicomputer use?
3. What level of computer expertise must a PSRO data manager have in order to use effectively a mini system?
4. Is cost or data quality compromised or enhanced when the PSRO must take responsibility for data entry?
5. Can a mixed system, with a minicomputer providing data entry and error control but with a data processor (using a larger machine) providing PHDDS tape generation and data analysis, be constructed? Is it less costly or more effective than a minicomputer providing all functions?
6. To what extent does minicomputer use, in itself, affect the usual measures of PSRO data processing quality; e.g., timeliness of data, accuracy of entry, timeliness of PHDDS information, accuracy of PHDDS information, etc.

7. Will a minicomputer system, which offers analytical tools without additional cost, encourage the PSRO to do more data analysis than systems for which analysis is variably charged? If so, is this important to PSRO effectiveness?

To obtain some support for answers to the above questions, minicomputer systems were introduced into the two sites: one where the mini provided total PSRO data processing support, another where the mini was used strictly for data entry. The first site was active during the experimental period and generated some responses to the above list of questions. The second site only became operational near the end of the experimental period: the experience there demonstrated the feasibility of the approach without providing much insight into its cost-effectiveness.

Site 1: South Carolina Medical Care Foundation

The South Carolina Medical Care Foundation (SCMCF) runs the South Carolina state-wide PSRO, which has 120,000 discharges annually. All the discharges arrive at the PSRO on an SCMCF Hospital Discharge Abstract (Exhibit A) which is, in our experience is less complex than the typical PSRO hospital discharge abstract. The SCMCF abstract collects only a summary of the Continued Stay Certification activity (instead of data on each individual review) and is well formatted for keying.

The system used by SCMCF was purchased by the South Carolina Medical Building, Inc., to provide data processing services for the PSRO. The system consisted of the following hardware components:

1. A Digital Equipment Corporation LSI-11 microprocessor with 56K bytes of memory, power suppy and other necessary options. The CPU, chosen for a variety of technical reasons, is sufficiently powerful to handle up to eight simultaneous data entry stations. Cost approximately $4,000.

2. A 20 megabyte cartridge disk system. This mass storage unit, with 5 million bytes of removable storage and 15 million fixed, was considered of sufficient size to hold the system software, ICD tables and a year's worth of hospital discharge abstracts. Cost approximately $12,000.

3. A dual-drive floppy disk system. Each drive holds one easily removable floppy disk holding 300,000 bytes of data. The floppy is used for backup of small data files, programs, and an auxiliary system device. The entire system can be run from the floppy when the cartridge disk is not functioning. Cost approximately $4,500.

4. An industry-compatible magnetic tape drive. Installed on the SCMCF system to provide a medium for disk backup and a device on which to produce PHDDS and other transfer tapes. The tape system can also be used in settings where a PSRO receives some or all of its data on tape from hospital data processing centers or hospital discharge abstracting services. Cost approximately $4,500

5. A 200-line-per-minute printer. Used for printing error logs, batch reports and other hard-copy results. Cost approximately $5,000.

6. Three video terminals. Each terminal can be used for data entry, system control, programming or interactive analysis. Cost approximately $2,000 each = $6,000.

This configuration is not the only feasible full-service PSRO data processing system, but it is fairly representative of the hardware investment ($42,000) that is necessary to support a PSRO of this size. With a three-year, 12% amortization and an allowance of 1.5% per month for hardware maintenance, this configuration will cost approximately $2,016 per month. To obtain a reasonable estimate of the cost to the PSRO, however, it is necessary to multiply this figure by the fraction of the machine's time that is devoted to PSRO processing (as opposed to non-PSRO processing by the South Carolina Medical Building (SCMB)). SCMB reports that one data entry operator can enter between 300 and 400 abstracts per day.

Since three operators can be active simultaneously (on a three-terminal system), then (conservatively) 1000 abstracts a day can be entered. The PSRO reports an initial entry error rate of four to six percent. Using the higher figure, then 1.06 times 120,000 abstracts must be entered each year, resulting in 128 full days of data entry. To get an upper bound on the machine time used for report generation, assume that 20 reports, requiring an average of one hour each, are run monthly. This would require 240 hours = 30 days of machine time per year. The rest of the machine time will go to program development and other non-PSRO processing. 158/260 days (61%) PSRO utilization results in $1,230 per month hardware cost to the PSRO, or 12.3 cents per discharge for hardware.

Other costs for mini-data processing exceed those related to hardware. SCMB provided a full-time Data Processing Manager/Programmer to supervise all data processing activities and to construct software for both its PSRO and non-PSRO activities. This person had a significant computer science background and excellent programming abilities. These attributes turned out to be central to the success of this particular installation, as discussed below. In addition, the equivalent of two full-time professional keying personnel were hired to provide data entry. Whether other PSRO or SCMB personnel time could be reasonably allocated to data processing was not reported, nor were data processing salaries reported. However, it is not unreasonable to estimate an annual personnel cost in the neighborhood of $50,000. Not all of the time of the Data Processing Manager is allocable to the PSRO, however, Assuming that his time can be allocated according to the same ratio as the machine itself, then we can estimate that 35 cents per discharge are spent on data processing personnel.

The machinery was housed in a space of approximately 400 square feet in the South Carolina Medical Building, in which the PSRO offices are also located. The incremental rental associated with the machine was not reported, but can be estimated between $1,000 to $2,000 annually. No special environmental costs (electrical supply, air conditioning, etc.) were reported. Supplies included printer paper and magnetic media (cartridge disks, floppy disks, and tapes). Startup costs for supplies will differ from on-going costs, which are estimated at approximately $600 per year. Thus, the minor costs associated with the data processing system can be estimated at about 1.7 cents per discharge.

The total cost of the system to the PSRO is thus estimated at 49 cents per discharge ($58,800 annually). Errors in the above estimates could vary the total 5 cents either way, so the true cost is likely to be between 45 and 55 cents per discharge.

The system described above was installed during March of 1978. All 1978 discharges were entered and PHDDS tapes generated on the system for the PSRO. Although it was our intention for the minicomputer system at SCMB to demonstrate a full-service PSRO data processing operation, interactive analysis software on the minicomputer was not available during the experimental period. The PSRO responded to this software shortage in two ways: 1) data entered on the mini was transferred to the IBM 370/168 at the nearby University of South Carolina where AUTOGRP could be used , and 2) the Data Processing Manager constructed a large number of report programs (in FORTRAN). These activities while both enhancing the effectiveness of the system for the PSRO, were not typical of the projected PSRO use of an in-house computer. Both required more expertise and time from the Data Manager than a PSRO can reasonably be expected to provide, and the first required easy and inexpensive access to a large computing facility. The time spent by the Data Manager in coding and debugging report programs is not covered by the personnel-cost estimates above, since in the typical PSRO situation, an in-house system would be acquired with the necessary software for periodic reports and interactive database analysis.

SCMB reported the successful use of the minicomputer system to supply their PSRO data processing needs. Data entry is performed by two professional keying persons, one with five years experience and the other with two. It can be observed here that keying experience and a professional orientation toward keying can make a significant difference (better than a factor of two) in keystroke rates and accuracy. SCMB chose to use full-time professional keying persons with prior experience, and achieved a high data entry efficiency. SCMB reported that each keyer could enter approximately 57 abstracts per hour (375-400 per seven-hour day when there is no downtime). Each SCMCF abstract requires approximately 150 keystrokes, resulting in a keystroke rate of 8550/hour. The data entry system catches many errors at the time of entry, most commonly for SCMCF: invalid physician numbers, invalid diagnoses, incorrectly calculated length of stay, and omitted dates. When an error is detected, those due to incorrect keying are corrected immediately. Errors on the abstract are entered into the database, but the record is flagged and the abstract is set aside to be sent to the hospital for correction. Approximately 4-6% of the abstracts are entered with an error that must be corrected. These are returned and the corrections entered interactively. After this correction process, a 1-2% error rate remains. At the end of each quarter, approximately 3000 of 40,000 records must be carried over to the next quarter. These consist of errors remaining after the current quarter has been first corrected and errors carried over from previous quarters.

Exhibit B contains a copy of South Carolina's Lag Analysis report. Though lag time (time from discharge to entry into the database) varies significantly from hospital to hospital, over half of the discharges are on-line within thirty days, and most are on-line within sixty. SCMCF is able to submit approximately 65-70% of the records processed per quarter on that quarter's PHDDS tape, with an average error rate of .003 (varying between 0 and .007). Approximately 20,000 records are submitted on each quarterly PHDDS tape, with between 30 and 50 records still containing errors. Within four days of the end of each quarter, data have been transferred to the USC computer center and are available for AUTOGRP analysis.

Machine downtime has averaged below 13 hours per month, generally not severely impacting the PSRO's ability to enter data into the database, provide for AUTOGRP analysis, or generate PHDDS output on a timely basis. When a hardware problem does occur, it is usually serious enough to require two or more hours of downtime for repair. The need for FORTRAN program development, brought on by the shortage of integrated interactive analysis software during the experimental period, caused an atypical amount of "reduced operation" time since the FORTRAN compiler does not coexist with the data entry system. The average amount of machine time devoted to FORTRAN programming and batch report processing was not reported, but could have expanded to as much as 39% of the (first-shift) machine capacity.

California Area XVIII PSRO (Pasadena)

Area XVIII is a much smaller PSRO than South Carolina (40,000 vs. 120,000). Since a $42,000 hardware system (amortized to $2016 per month) would cost 61 cents per discharge, it was judged infeasible for a PSRO of that size to acquire a full-service in-house PSRO data processing system. [Area XVIII has since joined with four other Los Angeles - area PSROs to form a data consortium which can afford a full-service system]. However, the advantages in accuracy and timeliness available from mini data entry could be obtained by installing a minicomputer data entry system which would feed into a larger machine for report generation, PHDDS generation and interactive analysis.

The system configured for Area XVIII consisted of the following components:

1. A DEC LSI-11 with the same options as that used for SCMCF. Cost $4,000
2. A three-drive, double-density floppy disk system. Each drive would hold a floppy disk containing 600,000 bytes. With a three-drive system, one drive can hold system software, the second drive can hold ICD tables, and the third drive can hold up to 2,000 Area XVIII discharge abstracts (slightly more than two week's worth). Cost $5,500.
3. One video terminal. Since three terminals supported data entry of 120,000 abstracts at SCMCF (and only two were generally used for data entry), it was assumed that one terminal would be sufficient for the data entry of 40,000 abstracts. Cost $2,000.
4. One low-speed (30 character per second) hard-copy terminal. Area XVIII did not need high-speed printing capability since large scale reports were to be produced on the large machine. The small printer doubled as a mini error logging device and an AUTOGRP terminal. Cost $1,500.

The total cost of the system was $13,000. With the same amortization and maintenance schedule used for SCMCF, this costs $624 per month or 18.7 cents per discharge.

The system was used in the following way. Two floppy disks were allocated to hold data for each month. Abstracts were entered, with error checking at entry time as usual. At the end of each month, an error report was produced indicating which abstracts on the month's disks were still in error, and those abstracts were flagged on the database. The two disks were copied and the copies sent to Yale. (The copy operation takes less than 5 minutes per disk). At Yale, the disks were mounted on a machine having both a double density floppy disk drive and an industry compatible tape drive. The database was then copied to tape and the tape carried to the IBM 370/158 at the Yale Computer Center. Programs at YCC translated the tape into an AUTOGRP format and placed the records into an AUTOGRP database. Other programs generated a PHDDS-format tape.

As corrections to errors detected during data entry came into the Area XVIII offices, the records involved were updated on the appropriate disks. After a period, the disks at Area XVIII would disagree significantly (due to corrections), with the data of the AUTOGRP files at Yale. At this point, the process given above would have to be repeated, with the additional step of removing the duplicate records from the 370 database.

This mode of operation turned out to be significantly more expensive than the full-service operation at SCMCF, since three sources of cost were added: personnel time to supervise and execute the data transfer from the mini to the 370, 370 machine time to manage the data and produce PHDDS tapes, and 370 AUTOGRP time. Cost figures must be based on estimates since the Area XVIII installation was unable to begin full-scale operations during the experimantal period. A part-time Data Manager and a sequence of data entry operators implemented the system during the third and fourth quarter of 1978. Salary figures were not reported. Conservatively assuming the same level of personnel committment at Area XVIII as at SCMCF, 35 cents per abstract must be allocated.

The smaller machine at Area XVIII takes up negligible office space (no more than an ordinary desk) and requires only floppy disks and terminal paper in the way of supplies. At most $45 per month were spent on supplies (1.3 cents per discharge). This yields an estimate of 55 cents per discharge for the minicomputer data entry portion of the system.

With monthly update of the 370 database and monthly correction of the 370 database (which was preferred by the PSRO due to their heavy dependence on AUTOGRP analysis of timely data for overall PSRO effectiveness), two programmer days per month were required to supervise and execute the update process. This cost ($300 with fringe and overhead) plus an average of $50 in 370 machine time added 10.5 cents to the per-discharge cost of the system. Under the 75 cent limitation at the time, the PSRO was then left with 75 cents less 65.5 or 9.5 cents per discharge for AUTOGRP analysis. With only 40,000 discharges, 9.5 cents per discharge would provide only about $300 per month or 15-20 hours of AUTOGRP time. In practice, Area XVIII was not bounded by this arithmetic since they had AUTOGRP access separately funded under the experiment. Further, the large amount of data handling introduced errors (e.g., one of a month's disks being copied to tape twice generating both duplicates and loss of the data from the second disk) which were potentially expensive to repair.

Area XVIII, enjoying the benefits of both in-house, PSRO-controlled data entry and large machine AUTOGRP analysis (because they were not being bound by the usual per-discharge cost ceilings), were satisfied with the installation, except for PHDDS generation delays caused by errors in mini-to-370 data handling. The Area XVIII Data Manager became proficient in the use of a preliminary version of minicomputer interactive analysis software so data available to the PSRO on floppies that had not made its way through the mini-to-370 process could still be included in needed summaries and counts.

Summary and Conclustions

The experiences of SCMCF and California Area XVIII provide some insight into the feasibility and effectiveness of minicomputer support for PSRO data processing. With reference to our original list of questions:

1. Feasibility. During the experimental period, data entry, error checking, PHDDS generation and some batch reporting was executed on the minicomputer. Interactive database analysis software was needed to provide complete PSRO support. [It has since been developed and is in use in several PSROs.]

2. Size to cover fixed costs. A full-size PSRO processing system requires a tape drive and a cartridge disk. It is difficult to provide these in a system costing less than about $40,000 in hardware ($1920 per month). Allocating .20 cents for keying personnel, 15 cents for management personnel and 2 cents for supplies, 38 cents of a 75 cent bound remain. At this rate, 60,000 discharges will just support the hardware cost, but PSRO generally requires software and setup support (which were provided without cost during this experiment). A full-scale system appears to be too costly for PSROs much under 100,000 discharges (at the 75-cent level). [Two events have occurred which affect this conclusion since the end of the experiment: in recognition of the fact that effective data analysis can significantly improve the impact of the entire PSRO program, HSQB has lifted the 75-cent limit; further, PSROs are joining into data consortia to generate the volume necessary to make PSRO-controlled data processing cost justified.]

3. Level of expertise. In the experimental settings, both Data Managers had significant data processing backgrounds. Due to the shortage of field-proven software, this was fortunate. As PSRO software is developed and used, however, the need for a PSRO data manager to be able to write programs will disappear [This has indeed happened since the experiment.]

4. PSRO responsibility for data entry. With the proper tools, which include a data entry system that detects keying errors at the time of entry, a database error analysis system that can be run at any time on any subset of the database, an error logging mechanism that records with any record the errors that are pending for that record, and a batch control system that requires data entry of batch identification and reference of that identification on each record, the PSRO data manager can insure a high quality of data entry.

5. Mixed vs. full-function. Mixed systems with frequent update of the 370 database are more expensive. Full-function systems may be backed up by AUTOGRP analysis on large machines, but the construction of the AUTOGRP databases should be done no more frequently then quarterly.

6. Quality and timeliness. Comparison of the SCMCF results with those of PSROs with alternative data processing configurations shows that the PSRO with an in-house system should expect no deterioration in the timeliness or accuracy of on-line or PHDDS data. Significant improvements are possible.

7. Analytical tools. Such tools were not readily available on the minicomputer during the experimental period. However, Area XVIII which already had considerable access to AUTOGRP on the large machine, invested a significant amount of Data Manager time in learning how to use the preliminary interactive analysis tools on the mini. With this ability, they were able to generate analyses of data as soon as they were entered into the database. If this is representative of the general PSRO attitude, then the availability of interactive software on the mini [developed after the experimental period] will encourage PSROs to do more analysis and do that analysis on more up-to-date data, which should enhance the effectiveness of the individual PSRO and of the program as a whole.

Intermediate Systems Not Evaluated

We intended at the outset to evaluate a range of systems which would include the integration of the AUTOGRP capability with existing standard data processor arrangements. Three possibilities for this existed as follows:

1. Multnomah Foundation for Medical Care and Dikewood
2. Dade-Monroe PSRO and Optimum Systems, Inc.
3. WISPRO and Wisconsin Physician's Service

In the first case, MFMC already had a data entry and editing system utilizing a mini-computer provided by Dikewood, but which could not be interfaced directly with AUTOGRP. We had developed a data entry and editing system as described earlier that did interface directly with AUTOGRP but utilized a micro-computer different than that one used by Dikewood in their system. We offered our system and support to Dikewood if they would substitute the appropriate processor. By our calculations, it would at worst have been a break-even effort from their point of view and would have given them involvement in the project and experience with AUTOGRP in the PSRO setting. Unfortunately, they declined to participate although several members of the company spent time with us both in Albuquerque and New Haven exploring the project. We do not know the basis for their decision, but were unable to pursue this alternative and MFMC continued with its existing system.

In the case of Dade-Monroe, we installed AUTOGRP at OSI both in Santa Clara (batch) and Rockville, Maryland (time-sharing). Benchmarks on cost were run as detailed elsewhere in this report. However, at about this time the PSRO entered into litigation with OSI for alleged failure to provide timely and accurate dataprocessing service. OSI ceased to be Dade-Monroe's processor and we were unable to pursue this alternative.

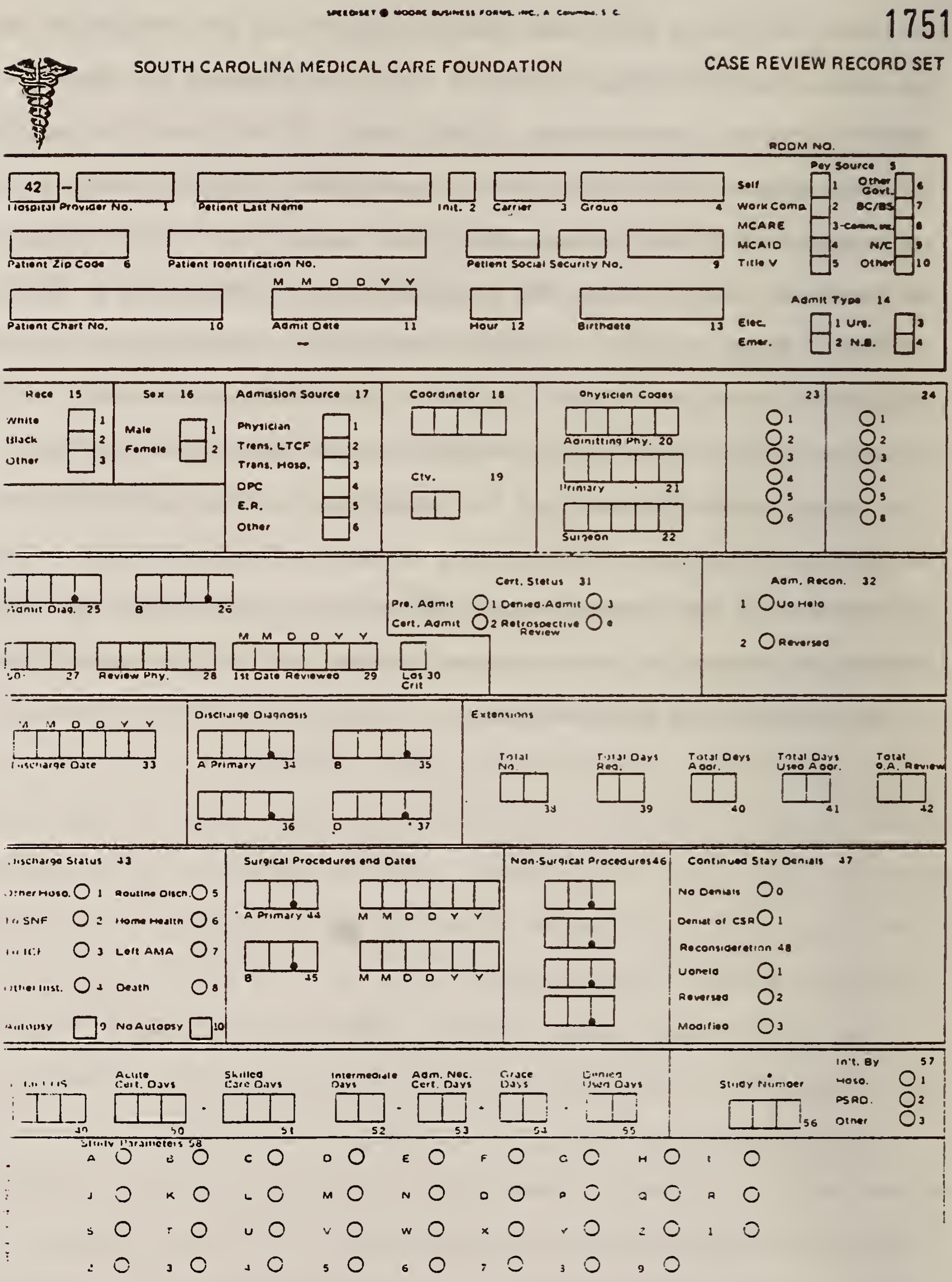
During the initial months of the contract WPS, the processor for the Wisconsin PSRO (WISPRO), indicated a willingness to participate in this demonstration by providing AUTOGRP support to WISPRO. At that time they operated an IBM 370/145 running under DOS. They had plans to switch to an IBM 370/148 with VM/370 as its operating system, under which they would run both a DOS machine (for batch processing) and a CMS machine (Cambridge Monitoring System) for time sharing. In April they were ready for AUTOGRP installation. Members of the Center staff went to WPS to perform this task in April and May. Tests were made and the same benchmark used at OSI was run. Exhibit C contains a summary of resources used - WPS has not yet set its unit charges.

From May 1978, WPS reported technical difficulties with their system. When they brought up VM/370 so as to run the CMS machine, the DOS machine did not operate efficiently in that VM consumed too much of the CPU in system overhead and batch operations slowed down. This situation was aggravated by the company taking on new contracts requiring a large number of video terminals to operate under DOS. Under VM/370 the response time of the video terminals degraded significantly and in a manner they could not tolerate for the new increased workload. As a result, they decided not to allow CML/AUTOGRP to be oeprated under CMS during prime time. Later it was decided by WPS not to offer WISPRO AUTOGRP service at all during the period of this contract. Thus, we were unable to evaluate this third proposed configuration.

It seems to us that our expectations with respect to response of processors to this project was not realistic in view of their own goals and interests. We expected all parties to accept our view of improving the efficiency and effectiveness of the PSRO data management and information system effort. In fact, every processor was primarily concerned with his own business interests which, in general, included PSRO's only peripherally. Dikewood principals, for example, told us that PSRO data processing was a marginal operation for them and was too risky as a venture for them to consider alternatives to their existing approach. Processors were not really concerned with systems and approaches which they viewed as outside their current interests and capabilities. AUTOGRP and our mini-computer systems appeared to them to be definitely outside those interests. Some processors were willing and, in fact, anxious to get support from the contract but were not willing to "buy" into the project by providing an ongoing relationship and liaison person. In retrospect, we did not really give them enough information to allow them to evaluate properly the extent to which their own interests might be served by participation. In any case, we did not get the involvement needed, and were unable to convince processors that any value for them would result from effort on their part.

Some PSRO's not associated with the project and who worked with these processors were able independently to set up arrangements for limited AUTOGRP services. Essex County got OSI to put up their data but were restricted to batch rather than interactive service. They were allowed to put a series of AUTOGRP commands in a file, submit the file as a batch job, and some time later get the resulting output file printed at their terminal. While this makes AUTOGRP available, it does not do so in a manner appropriate to its capability. The experience indicated some uses could be effective, but the mode tended to inhibit rather than promote its use.

San Francisco PSRO arranged for AUTOGRP service through Dikewood and was given such service via timesharing by Boeing Computer Services. They were able to do some analyses much like the project PSRO's but the cost was prohibitive compared to costs incurred by PSRO's at the Yale Computer Center or the University of South Carolina.



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1751

SOUTH CAROLINA MEDICAL CARE FOUNDATION

CASE REVIEW RECORD SET

ROOM NO.

42 – ☐ Hospital Provider No. 1
☐ Patient Last Name
☐ Init. 2
☐ Carrier 3
☐ Group 4

Pay Source 5
Self ☐ 1
Work Comp. ☐ 2
MCARE ☐ 3
MCAID ☐ 4
Title V ☐ 5
Other Govt. ☐ 6
BC/BS ☐ 7
Comm. Ins. ☐ 8
N/C ☐ 9
Other ☐ 10

☐ Patient Zip Code 6
☐ Patient Identification No.
☐ Patient Social Security No. 9

☐ Patient Chart No. 10
M M D D Y Y ☐ Admit Date 11
☐ Hour 12
☐ Birthdate 13

Admit Type 14
Elec. ☐ 1
Emer. ☐ 2
Urg. ☐ 3
N.B. ☐ 4

Race 15
White ☐ 1
Black ☐ 2
Other ☐ 3

Sex 16
Male ☐ 1
Female ☐ 2

Admission Source 17
Physician ☐ 1
Trans. LTCF ☐ 2
Trans. Hosp. ☐ 3
OPC ☐ 4
E.R. ☐ 5
Other ☐ 6

Coordinator 18 ☐☐☐☐
Cty. 19 ☐☐

Physician Codes
☐☐☐☐☐ Admitting Phy. 20
☐☐☐☐☐ Primary 21
☐☐☐☐☐ Surgeon 22

23
○ 1
○ 2
○ 3
○ 4
○ 5
○ 6

24
○ 1
○ 2
○ 3
○ 4
○ 5
○ 6

☐☐☐☐ Admit Diag. 25
☐☐☐☐ B 26
☐☐☐ 27
☐☐☐☐☐ Review Phy. 28
M M D D Y Y ☐☐☐☐☐☐ 1st Date Reviewed 29
☐ Los 30 Crit

Cert. Status 31
Pre. Admit ○ 1 Denied-Admit ○ 3
Cert. Admit ○ 2 Retrospective Review ○ 4

Adm. Recon. 32
1 ○ Upheld
2 ○ Reversed

M M D D Y Y ☐☐☐☐☐☐ Discharge Date 33

Discharge Diagnosis
☐☐☐☐ A Primary 34
☐☐☐☐ B 35
☐☐☐☐ C 36
☐☐☐☐ D 37

Extensions
☐☐ Total No. 38
☐☐ Total Days Req. 39
☐☐ Total Days Appr. 40
☐☐ Total Days Used Appr. 41
☐☐ Total O.A. Review 42

Discharge Status 43
Other Hosp. ○ 1
To SNF ○ 2
To ICF ○ 3
Other Inst. ○ 4
Autopsy ☐ 9
Routine Disch. ○ 5
Home Health ○ 6
Left AMA ○ 7
Death ○ 8
No Autopsy ☐ 10

Surgical Procedures and Dates
☐☐☐ A Primary 44 — M M D D Y Y ☐☐☐☐☐☐
☐☐☐ B 45 — M M D D Y Y ☐☐☐☐☐☐

Non-Surgical Procedures 46
☐☐☐
☐☐☐
☐☐☐
☐☐☐

Continued Stay Denials 47
No Denials ○ 0
Denial of CSR ○ 1
Reconsideration 48
Upheld ○ 1
Reversed ○ 2
Modified ○ 3

☐☐☐ LOS 49
Acute Cert. Days ☐☐☐ 50
Skilled Care Days ☐☐☐ 51
Intermediate Days ☐☐ 52
Adm. Nec. Cert. Days ☐☐ 53
Grace Days ☐☐ 54
Denied Used Days ☐☐ 55
Study Number ☐☐☐ 56

In't. By 57
Hosp. ○ 1
PSRO. ○ 2
Other ○ 3

Study Parameters 58
A ○ B ○ C ○ D ○ E ○ F ○ G ○ H ○ I ○
J ○ K ○ L ○ M ○ N ○ O ○ P ○ Q ○ R ○
S ○ T ○ U ○ V ○ W ○ X ○ Y ○ Z ○ 1 ○
2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○

Exhibit A

SOUTH CAROLINA MEDICAL BUILDING, INC
DATA PROCESSING CENTER
SOUTH CAROLINA MEDICAL CARE FOUNDATION
HOSPITAL LAG ANALYSIS REPORT

DATE: JULY-OCT 78 QTR

HOSPITAL	TOTAL RECEIVED	00 - 30 DAYS		31 - 60 DAYS		61 - 90 DAYS		91 - 120 DAYS		121 - 150 DAYS		151 - 180 DAYS		OVER 180 DAYS	
40083.	283.	144.	50.88	100.	35.34	29.	10.25	3.	1.06	6.	2.12	0.	0.00	1.	0.35
40084.	9.	1.	11.11	4.	44.44	3.	33.33	0.	0.00	0.	0.00	1.	11.11	0.	0.00
40085.	532.	42.	7.89	240.	45.11	146.	27.44	98.	18.42	4.	0.75	1.	0.19	1.	0.19
40086.	250.	159.	63.60	84.	33.60	7.	2.80	0.	0.00	0.	0.00	0.	0.00	0.	0.00
40903.	21.	0.	0.00	9.	42.86	6.	28.57	3.	14.29	2.	9.52	0.	0.00	1.	4.76
43000.	28.	2.	7.14	5.	17.86	6.	21.43	9.	32.14	5.	17.86	1.	3.57	0.	0.00
99999.	3.	1.	33.33	1.	33.33	1.	33.33	0.	0.00	0.	0.00	0.	0.00	0.	0.00

Exhibit B

Comparison of Resources and Charges for AUTOGRP Benchmark File

Yale Computer Center

Resource	Quantity	Units	*Charge Unit	Total
Disk Blocks	2.951	1000 events	.55	$ 1.62
Core Occupancy	3.011	100k* min	1.50	4.52
** Connect	.406	hour	1.40	.57
CPU	.722	min	6.00	4.33
				$11.04

Optimum Systems

Resource	Quantity	Units	*Charge Unit	Total
I/O	28	sec	$ .30	$ 8.53
Main Core (core occ)	3.9	1000* hour	3.60	14.04
Connect	.43	hour	8.00	3.46
CPU	40.6	sec	.45	18.27
Tputs	.89	1000	2.00	1.78
				$46.08

WPS

Resource	Quantity	Units	Charge Unit	Total
Connect	952	sec		
Processor Time (including supervisor functions)	98901	1000* sec		
Virtual Processor Time	70361	1000* sec		
Page Reads	1383			
Page Writes	816			
Virtual Machine SIO instructions for non spooled I/O	5590			
Spooled lines	1011			

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*Charges as of December 1977

** Does NOT include TELENET charges, which can be up to $7.00/hour for users connecting outside the New Haven area

Exhibit C

Appendix A

Diagnosis Related Group Descriptions

Appendix A

Diagnosis Related Group Descriptions

MAJOR DIAGNOSIS CATEGORY	DIAGNOSIS RELATED GROUPS	
01: Infectious Diseases	001	Infectious Disease (Enteritis, Diarrhea) with Age less than 16
	002	Infectious Disease (Enteritis, Diarrhea) with Age greater than 15
	003	Infectious Disease (Viral Disease, VD, Meningitis) without Secondary Diagnosis
	004	Infectious Disease (Viral Disease, VD, Meningitis) with Secondary Diagnosis
	005	Infectious Disease (Blood Infection, TB, Salmonella) without Surgery
	006	Infectious Disease (Blood Infection, TB, Salmonella) with Surgery
02: Malignant Neoplasm of the Digestive System	007	Cancer of the Mouth, Tongue, Large Intestine, Liver, Gallbladder without Surgery
	008	Cancer of the GI System (Esophagus, Stomach, Pancreas, Small Intestine, Rectum) without Surgery
	009	Cancer of the GI System with Surgical Procedure (Biopsy, Endoscopy, Local Excision, Centesis) without Secondary Diagnosis
	010	Cancer of the GI System with Surgical Procedure (Biopsy, Endoscopy, Local Excision, Draining) with Secondary Diagnosis
	011	Cancer of the GI System with Surgery (Gastric Resection, Colon Resection, Esophagus Resection)
03: Malignant Neoplasm of the Respiratory System	012	Cancer of the Respiratory System (Trachea, Lung, Larynx, Thorax, Mediastinum) without Surgery without Secondary Diagnosis
	013	Cancer of the Respiratory System (Trachea, Lung, Larynx, Thorax, Mediastinum) without Surgery with Secondary Diagnosis
	014	Cancer of the Respiratory System with Surgical Procedure (Biopsy, Endoscopy, Excision of Lesion) without Secondary Diagnosis
	015	Cancer of the Respiratory System with Surgical Procedure (Biopsy, Endoscopy, Excision of Lesion) with Secondary Diagnosis
	016	Cancer of the Respiratory System with Surgery (Lobectomy, Laryngectomy, Radical Resection)
04: Malignant Neoplasm of the Skin	017	Cancer of the Skin except Malignant Melanoma without Secondary Diagnosis
	018	Cancer of the Skin except Malignant Melanoma with Secondary Diagnosis
	019	Cancer of the Skin - Malignant Melanoma with Surgical Procedure without Secondary Diagnosis
	020	Cancer of the Skin - Malignant Melanoma with Surgical Procedure with Secondary Diagnosis
05: Malignant Neoplasm of the Breast	021	Cancer of the Breast without Surgery with Age less than 63
	022	Cancer of the Breast without Surgery with Age greater than 62
	023	Cancer of the Breast with Surgery without Secondary Diagnosis
	024	Cancer of the Breast with Surgery with Secondary Diagnosis
06: Malignant Neoplasm of the Female Reproductive System	025	Cancer of the Female Reproductive System (Uterus, Cervix, Vagina, Ovary, Fallopian Tube) without Surgery without Secondary Diagnosis
	026	Cancer of the Female Reproductive System (Uterus, Cervix, Vagina, Ovary, Fallopian Tube) without Surgery with Secondary Diagnosis
	027	Cancer of the Female Reproductive System with Surgical Procedure (D&C, Biopsy, Excision of Lesion) without Secondary Diagnosis
	028	Cancer of the Female Reproductive System with Surgical Procedure (D&C, Biopsy, Excision of Lesion) with Secondary Diagnosis
	029	Cancer of the Uterus Body with Surgery (Removal of Uterus)
	030	Cancer of the Uterus, Cervix, Ovary with Surgery (Removal of Uterus or other Major Operation)

07: Malignant Neoplasm of the Male Reproductive System	031	Cancer of the Male Reproductive System (Penis, Prostate, Testicle) without Surgery
	032	Cancer of the Male Reproductive System with Surgical Procedure (Biopsy, Cystoscopy, Removal of Testicle) without Secondary Diagnosis
	033	Cancer of the Male Reproductive System with Surgical Procedure (Biopsy, Cystoscopy, Removal of Testicle) with Secondary Diagnosis
	034	Cancer of the Male Reproductive System with Surgery (Amputation of Penis, Removal of Prostate, Radical Excision of Lesion)
08: Malignant Neoplasm of the Urinary System	035	Cancer of the Urinary System (Bladder, Urethra, Kidney, Ureter) without Surgery
	036	Cancer of the Urinary System with Surgical Procedure (Cystoscopy, TUR, Excision of Lesion) without Secondary Diagnosis
	037	Cancer of the Urinary System with Surgical Procedure (Cystoscopy, TUR, Excision of Lesion) with Secondary Diagnosis
	038	Cancer of the Urinary System with Surgery (Removal/Excision of Bladder, Kidney, Ureter, Urethra)
09: Malignant Neoplasm of Other and Unspecified Sites	039	Cancer of the Bone, Thyroid, Connective Tissue, Nerves without Surgery
	040	Cancer of the Brain, Secondary Cancer, Multiple Cancer Sites without Surgery without Secondary Diagnosis
	041	Cancer of the Brain, Secondary Cancer, Multiple Cancer Sites without Surgery with Secondary Diagnosis
	042	Cancer of the Thyroid, Connective Tissue, Nerves with Surgical Procedure (Biopsy, Excision)
	043	Cancer of a Secondary Site, Multiple Sites with Surgical Procedure (Biopsy, Excision)
	044	Cancer of the Bone, Connective Tissue, Nerves, Secondary Site, Multiple Sites with Surgery
1 Neoplasm of the Lymphatic and Hemopoietic Tissue	045	Tumor of the Lymphatic System, Blood Making Tissue without Secondary Diagnosis with Age less than 16
	046	Tumor of the Lymphatic System, Blood Making Tissue with Secondary Diagnosis with Age less than 16
	047	Disease of the Lymphatic System, Hodgkins Disease, Sarcoma without Surgery without Secondary Diagnosis with Age greater than 15
	048	Disease of the Lymphatic System, Hodgkins Disease, Sarcoma without Surgery with Secondary Diagnosis with Age greater than 15
	049	Tumor of the Lymphatic System, Multiple Myeloma, Leukemia without Surgery with Age greater than 15
	050	Tumor of the Lymphatic System, Blood Making Tissue with Surgical Procedure (Excision of Node) without Secondary Diagnosis with Age greater than 15
	051	Tumor of the Lymphatic System, Blood Making Tissue with Surgical Procedure (Excision of Node) with Secondary Diagnosis with Age greater than 15
	052	Tumor of the Lymphatic System, Blood Making Tissue with Surgery (Splenectomy, Radical Resection) with Age greater than 15
1: Benign Neoplasm of the Female Reproductive System	053	Benign Tumor (Papilloma, Polyp) of the Uterus, Vagina, Vulva without Secondary Diagnosis
	054	Benign Tumor (Papilloma, Polyp) of the Uterus, Vagina, Vulva with Secondary Diagnosis
	055	Benign Tumor (Fibroma) of the Uterus, Ovary without Surgery
	056	Benign Tumor (Fibroma) of the Uterus, Ovary with Surgical Procedure (D&C, Excision of Lesion) without Second Surgery
	057	Benign Tumor (Fibroma) of the Uterus, Ovary with Second Surgery
	058	Benign Tumor (Fibroma) of the Uterus, Ovary with Surgery (Removal of Ovary)
	059	Benign Tumor (Fibroma) of the Uterus, Ovary with Surgery (Removal of Uterus)

12:	Benign Neoplasm of Other Sites	060 Benign Tumor of the Intestines, Urinary System, without Surgery
		061 Benign Tumor of the Brain, Pituitary Gland without Surgery
		062 Benign Tumor of the Skin, Bone, Urinary System (Kidney, Bladder), Connective Tissue with Surgery without Secondary Diagnosis
		063 Benign Tumor of the Skin, Bone, Urinary System (Kidney, Bladder), Connective Tissue with Surgery with Secondary Diagnosis with Age less than 43
		064 Benign Tumor of the Skin, Bone, Urinary System (Kidney, Bladder), Connective Tissue with Surgery with Secondary Diagnosis with Age greater than 42
		065 Benign Tumor of the Intestines, Nerves with Surgical Procedure (Excision, Other) without Secondary Diagnosis
		066 Benign Tumor of the Intestines, Nerves with Surgical Procedure (Excision, Other with Secondary Diagnosis
		067 Benign Tumor of the Intestines, Nerves with Surgery (Colon Resection Craniotomy Radical Resection, Other Major Operation)
		068 Benign Tumor of the Stomach, Brain, Respiratory System, Esophagus, Pituitary Gland with Surgery
13:	Diseases of Thyroid and Other Endocrine Glands	069 Disease of the Thyroid (Non-Toxic, Simple), Other Endocrine Glands (Adrenal, Pancreas without Surgery
		070 Disease of the Thyroid (Toxic), Low Function Pituitary without Surgery
		071 Endocrine Disorder with Surgical Procedure (Thyroidectomy, Other)
		072 Endocrine Disorder with Surgery
14:	Diabetes	073 Diabetes without Surgery without Secondary Diagnosis or with Minor Secondary Diagnosis with Age less than 36
		074 Diabetes without Surgery without Secondary Diagnosis or with Minor Secondary Diagnosis with Age greater than [illegible]
		075 Diabetes without Surgery with Major Secondary Diagnosis
		076 Diabetes with Surgical Procedure (Endoscopy, Biopsy)
		077 Diabetes with Surgery (Amputation of Extremity, Other Major)
15:	Nutritional and Other Metabolic Diseases	078 Metabolic Disorder (Gout, Blood Globulin) without Secondary Diagnosis
		079 Metabolic Disorder (Gout, Blood Globulin) with Secondary Diagnosis (Nutrition Deficiency)
		080 Metabolic Disease (Cystic Fibrosis, Sprue, Unspecified)
		081 Metabolic Disease (Obesity, Malnutrition, Unspecified)
16:	Diseases of the Blood and Blood Forming Organs	082 Mediterranean Anemia, Hemophilia without Surgery without Secondary Diagnosis or with Minor Secondary Diagnosis with Age less than 11
		083 Mediterranean Anemia, Hemophilia without Surgery without Secondary Diagnosis or with Minor Secondary Diagnosis with Age greater than 10
		084 Disease of Blood Hemoglobin without Surgery without Secondary Diagnosis or with Minor Secondary Diagnosis
		085 Disease of the Blood (Anemias), Blood Forming Organs (Spleen) without Surgery with Major Secondary Diagnosis
		086 Disease of the Blood (Anemias), Blood Forming Organs with Surgery with Age 2-53
		087 Disease of the Blood (Anemias), Blood Forming Organs with Surgery with Age less than 2 or greater than 53
17:	Psychoses Not Attributed to Physical Conditions	088 Schizophrenia (Paranoid, Catatonic, Unspecified) Involutional Melancholia with Psychiatric Service
		089 Schizophrenia (Paranoid, Catatonic, Unspecified) Involutional Melancholia without Psychiatric Service
		090 Schizophrenia (Affective, Acute Episode), Manic - Depressive Psychosis

8: Neuroses	091	Neurosis (Anxiety, Hysterical, Phobic, Hypochondriacal Unspecified)
	092	Neurosis (Obsessive-Compulsive, Depressive), Personality Disorders
9: Alcoholic Mental Disorder and Addiction	093	Alcoholism without Secondary Diagnosis or with Minor Secondary Diagnosis
	094	Alcoholism with Major Secondary Diagnosis (Liver Cirrhosis, Delirium Tremens, Other)
0: Other Mental Disorders	095	Drug Dependence, Physical Disorder (Probably Psychiatric Origin), Cephalgia
	096	Psychosis, Non-Psychosis Related Brain Condition
1: Diseases of the Central Nervous System	097	Epilepsy, Migraine, Brain Disorder (Unspecified) without Surgery without Secondary Diagnosis
	098	Epilepsy, Migraine, Brain Disorder (Unspecified) without Surgery with Secondary Diagnosis
	099	Multiple Sclerosis, Paralysis Agitans, Meningitis, Hemiplegia without Surgery
	100	Disease of the Central Nervous System with Surgical Procedure (Nerve Block, Other)
	101	Disease of the Central Nervous System with Surgery (Laminectomy, Spinal Fusion, Ventricular Shunt)
2: Diseases of the Peripheral Nervous System	102	Facial Paralysis, Neuralgia (Trigeminal, Other Unspecified) without Surgery
	103	Sciatica, Polyneuritis without Surgery
	104	Disease of the Median Nerve with Surgery
	105	Disease of the Peripheral Nerves except Median with Surgical Procedure (Nerve Block, Other Unspecified)
	106	Disease of the Peripheral Nerves except Median with Surgery (Spinal Cord, Nerve Roots)
3. Diseases of the Eye	107	Cross Eyedness, Cataract, Cyst of the Eyelid without Surgery
	108	Glaucoma, Corneal Inflammation/Ulceration, Disease of the Iris, Retina without Surgery
	109	Disease of the Eye with Surgical Procedure (Muscle Repair of Eyelid, Other)
	110	Disease of the Eye with Surgical Procedure (Removal of Lens, Incision into Sclera)
	111	Disease of the Eye with Surgical Procedure (Reattachment of Retina, Repair of Cornea)
4: Disease of the Ear and Mastoid Process	112	Disease of the Middle Ear (Inflammation, Chronic Mastoid Bone Inflammation) without Surgery
	113	Disease of the Inner Ear (Inflammation, Menieres Disease) without Surgery
	114	Disease of the Ear with Surgical Procedure (Incision of Membrane, Removal of Adenoids, Other)
	115	Disease of the Middle Ear with Surgery (Removal of Bone, Repair of Membrane)
	116	Disease of the Ear with Surgery (Removal of Mastoid Bone, Excision of Middle Ear, Other)
5: Hypertensive Heart Diseases	117	Hypertensive Heart Disease without Surgery without Secondary Diagnosis or with Minor Secondary Diagnosis
	118	Hypertensive Heart Disease without Surgery with Major Secondary Diagnosis
	119	Hypertensive Heart Disease (Fatal) with Kidney Involvement without Surgery with Major Secondary Diagnosis
	120	Hypertensive Heart Disease with Surgery

26: Acute Myocardial Infarction	121	Disease of the Heart - Acute Myocardial Infarction
27: Ischemic Heart Diseases Except AMI	122	Disease of the Heart, Ischemia (Blood Deficiency) except AMI without Surgery with Secondary Diagnosis
	123	Disease of the Heart, Ischemia (Blood Deficiency) except AMI without Surgery with Minor Secondary Diagnosis
	124	Disease of the Heart, Ischemia (Blood Deficiency) except AMI without Surgery with Major Secondary Diagnosis
	125	Disease of the Heart, Ischemia (Blood Deficiency) except AMI with Cardiac Catheterization
	126	Disease of the Heart, Ischemia (Blood Deficiency) except AMI with Surgical Procedure (Endoscopy, Insertion of Electronic Device)
	127	Disease of the Heart, Ischemia (Blood Deficiency) except AMI with Surgery (Shunt, Other Major)
28: Arrythmia and Slowed Conduction	128	Disease of the Heart, Irregular Heart Rhythm, Slowed Conduction without Surgery without Secondary Diagnosis or with Minor Secondary Diagnosis
	129	Disease of the Heart, Irregular Heart Rhythm, Slowed Conduction without Surgery with Major Secondary Diagnosis
	130	Disease of the Heart, Irregular Heart Rhythm, Slowed Conduction with Replacement of Heart Device or Cardiac Catheterization
	131	Disease of the Heart, Irregular Heart Rhythm, Slowed Conduction with Insertion of Electronic Heart Device
29: Heart Failure	132	Disease of the Heart, Failure (Poor Function) without Surgery
	133	Disease of the Heart, Failure (Poor Function) with Surgery
30: Carditis, Valvular and Other Diseases	134	Disease of the Heart, Inflammation, Valve Problem without Surgery without Secondary Diagnosis or with Minor Secondary Diagnosis
	135	Disease of the Heart, Inflammation, Valve Problem without Surgery with Major Secondary Diagnosis
	136	Disease of the Heart, Inflammation, Valve Problem with Cardiac Catheterization without Secondary Diagnosis or with Minor Secondary Diagnosis
	137	Disease of the Heart, Inflammation, Valve Problem with Cardiac Catheterization with Major Secondary Diagnosis
	138	Disease of the Heart, Inflammation, Valve Problem with Surgery (Valve Replacement, Other Major)
31: Cerebrovascular Diseases	139	Circulatory Disorder of the Brain, Occasional Blood Deficiency without Surgery without Secondary Diagnosis or with Minor Secondary Diagnosis
	140	Circulatory Disorder of the Brain, Occasional Blood Deficiency without Surgery with Major Secondary Diagnosis
	141	Blood Clot in Brain Obstructing Circulation without Surgery without Secondary Diagnosis or with Minor Secondary Diagnosis
	142	Blood Clot in Brain Obstructing Circulation without Surgery with Major Secondary Diagnosis
	143	Brain Hemorrhage (Stroke) without Surgery without Secondary Diagnosis or with Minor Secondary Diagnosis
	144	Brain Hemorrhage (Stroke) without Surgery with Major Secondary Diagnosis
	145	Circulatory Dysfunction in Brain with Surgery
32: Diseases of the Vascular System	146	Disease of the Circulatory System, Inflammation of the Lymph Glands, Varicose Veins (Legs), Raynauds Disease without Surgery
	147	Disease of the Circulatory System (Hardening of Arterial Walls, Arterial Blood Clot) without Surgery without Secondary Diagnosis or with Minor Secondary Diagnosis
	148	Disease of the Circulatory System (Hardening of Arterial Walls, Arterial Blood Clot) without Surgery with Major Secondary Diagnosis
	149	Disease of the Circulatory System with Surgical Procedure (Excision of Varicose Veins, Other) with Age less than 51
	150	Disease of Vascular System with Surgery (Excision of Varicose Veins, Other) with Age greater than 50
	151	Disease of Vascular System with Surgery (Excision of Nerve, Vessel) without Secondary Diagnosis
	152	Disease of Vascular System with Surgery (Excision of Nerve, Vessel) with Secondary Diagnosis
	153	Disease of Vascular System with Surgery (Arterial Reconstruction, Amputation of Extremity)

33. Pulmonary Embolism	154	Blood Clot of the Lung without Secondary Diagnosis or with Minor Secondary Diagnosis
	155	Blood Clot of the Lung with Major Secondary Diagnosis
34: Phlebitis and Thrombophlebitis	156	Inflammation of the Veins, Blood Clot without Secondary Diagnosis or with Minor Secondary Diagnosis
	157	Inflammation of the Veins, Blood Clot with Major Secondary Diagnosis
35: Hemorrhoids	158	Hemorrhoids
36: Hypertrophy of Tonsil and Adenoid	159	Enlargement of the Tonsils/Adenoids
37: Acute Upper Respiratory Tract Infection and Influenza	160	Acute Upper Respiratory Tract Infection, Influenza with Age less than 45
	161	Acute Upper Respiratory Tract Infection, Influenza with Age greater than 44
38: Other Diseases of the Upper Respiratory Tract	162	Diseaae of the Upper Respiratory Tract except Acute Upper Respiratory Infection and Influenza without Surgery
	163	Disease of the Upper Respiratory Tract with Surgical Procedure (Biopsy, Visualization of the Nasal Septum)
	164	Disease of the Upper Respiratory Tract with Surgery (Nose Reconstruction, Incision and Drainage of Sinus)
39: Pneumonia	165	Pneumonia with Age less than 31
	166	Pneumonia without Surgery without Seconary Diagnosis with Age greater than 30
	167	Pneumonia without Surgery with Secondary Diagnosis with Age greater than 30
	168	Pneumonia with Surgery
40: Bronchitis	169	Bronchitis with Age less than 46
	170	Bronchitis without Secondary Diagnosis or with Minor Secondary Diagnosis with Age greater than 45
	171	Bronchitis with Major Secondary Diagnosis with Age greater than 45
41: Asthma	172	Aathma with Age less than 31
	173	Asthma without Secondary Diagnosis with Age greater than 30
	174	Asthma with Secondary Diagnosis with Age greater than 30
42: Other Lung and Pleural Diseases	175	Lung Collapse, Pleurisy, Pulmonary Congestion without Surgery
	176	Emphysema, Embyema, Abscess, Acute Swelling without Surgery without Secondary Diagnosi or with Minor Secondary Diagnosis
	177	Emphysema, Empyema, Abscess, Acute Swelling without Surgery with Major Secondary Diagnosis
	178	Disease of the Lung and Pleura with Surgical Procedure (Bronchoscopy, Chest Incision, Other) without Secondary Diagnosis
	179	Disease of the Lung and Pleura with Surgical Procedure (Bronchoscopy, Chest Incision, Other) with Secondary Diagnosis
	180	Disease of the Lung and Pleura with Surgery (Removal of Lobe, Other Major)
43: Diseases of the Oral Cavity, Salivary Glands and Jaw	181	Minor Problems of the Teeth
	182	Major Problems of the Teeth (Jaw, Salivary Glands, Other Oral Soft Tissue)
44: Gastric and Peptic Ulcer	183	Stomach Ulcer without Surgery without Secondary Diagnosis
	184	Stomach Ulcer without Surgery with Secondary Diagnosis
	185	Stomach Ulcer with Surgical Procedure (Biopsy, Visualization, Other)
	186	Stomach Ulcer with Surgery (Removal of Portion of Stomach, Other Major) without Secondary Diagnosis
	187	Stomach Ulcer with Surgery (Removal of Portion of Stomach, Other Major) with Secondary Diagnosis

45: Upper Gastro-Intestinal Diseases except Gastric and Peptic Ulcer	188	Upper GI Disease Except Stomach Ulcer without Surgery without Secondary Diagnosis
	189	Upper GI Disease Except Stomach Ulcer without Surgery with Secondary Diagnosis
	190	Upper GI Disease Except Stomach Ulcer with Surgical Procedure (Visualization, Other Minor) without Secondary Diagnosis
	191	Upper GI Disease Except Stomach Ulcer with Surgical Procedure (Visualization, Other Minor) with Secondary Diagnosis
	192	Upper GI Disease Except Stomach Ulcer with Surgery
46: Appendicitis	193	Appendicitis (without Peritonitis) without Secondary Diagnosis
	194	Appendicitis (without Peritonitis) with Secondary Diagnosis
	195	Appendicitis (with Peritonitis, Other) without Secondary Diagnosis
	196	Appendicitis (with Peritonitis, Other) with Secondary Diagnosis
47: Hernia of the Abdominal Cavity	197	Abdominal Hernia with Age less than 15
	198	Inguinal Hernia (without Obstruction) with Age greater than 14 and less than 65 without Secondary Diagnosis
	199	Inguinal Hernia (without Obstruction) with Age greater than 14 and less than 65 with Secondary Diagnosis
	200	Abdominal Hernia Except Simple Inguinal with Age greater than 14 and less than 65 without Surgery
	201	Abdominal Hernia Except Simple Inguinal with Age greater than 14 and less than 65 with Minor Surgery
	202	Abdominal Hernia Except Simple Inguinal with Age greater than 14 and less than 65 with Major Surgery
	203	Abdominal Hernia with Age greater than 64 without Surgery
	204	Abdominal Hernia with Age greater than 64 with Minor Surgery
	205	Abdominal Hernia with Age greater than 64 with Major Surgery
48: Enteritis, Diverticula, and Functional Disorders of the Intestine	206	Functional Disorder of the Intestine without Surgery
	207	Intestinal Pouching, Regional Enteritis, Ulcerative Colitis without Surgery
	208	Intestinal Pouching (Functional Disorder) with Minor Surgery without Secondary Diagnosis
	209	Intestinal Pouching (Functional Disorder) with Minor Surgery with Secondary Diagnosis
	210	Intestinal Pouching (Functional Disorder) with Major Surgery (Resection, Other)
49: Diseases of the Anus	211	Disease of the Anus without Secondary Diagnosis
	212	Disease of the Anus with Secondary Diagnosis
50: Miscellaneous Diseases of the Intestine and Peritoneum	213	Miscellaneous Disease of the Intestine and Abdominal Lining with Age less than 56 without Surgery
	214	Miscellaneous Disease of the Intestine and Abdominal Lining with Age greater than 55 without Surgery without Secondary Diagnosis
	215	Miscellaneous Disease of the Intestine and Abdominal Lining with Age greater than 55 without Surgery with Secondary Diagnosis
	216	Miscellaneous Disease of the Intestine and Abdominal Lining with Surgical Procedure (Local Incision, Excision)
	217	Miscellaneous Disease of the Intestine and Abdominal Lining with Visualization of the Intestine without Secondary Diagnosis
	218	Miscellaneous Disease of the Intestine and Abdominal Lining with Visualization of the Intestine with Secondary Diagnosis
	219	Miscellaneous Disease of the Intestine and Abdominal Lining with Major Surgery without Secondary Diagnosis
	220	Miscellaneous Disease of the Intestine and Abdominal Lining with Major Surgery with Secondary Diagnosis
51: Diseases of the Liver	221	Hepatitis,(Infectious, Serum) Subacute Necrosis of the Liver with Age less than 41

	222	Hepatitis (Infectious, Serum) Subacute Necrosis of the Liver with Age greater than 40
	223	Liver Cirrhosis without Secondary Diagnosis or with Minor Secondary Diagnosis
	224	Liver Cirrhosis with Major Secondary Diagnosis
52: Diseases of the Gall-Bladder and Bile Duct	225	Disease of the Gallbladder and Bile Duct without Surgery with Age less than 51
	226	Disease of the Gallbladder and Bile Duct without Surgery with Age greater than 50
	227	Disease of the Gallbladder and Bile Duct with Surgery without Secondary Diagnosis
	228	Disease of the Gallbladder and Bile Duct with Surgery with Secondary Diagnosis with Age less than 65
	229	Disease of the Gallbladder and Bile Duct with Surgery with Secondary Diagnosis with Age greater than 64
53: Diseases of the Pancreas	230	Disease of the Pancreas without Surgery
	231	Disease of the Pancreas with Surgery
54: Diseases of the Kidney and Ureter	232	Disease of the Kidney and Bladder without Surgery without Secondary Diagnosis
	233	Kidney Inflammation without Surgery with Secondary Diagnosis
	234	Nephrotic Syndrome, Nephritis (Chronic) Uremia without Surgery with Secondary Diagnosis with Age less than 65
	235	Nephrotic Syndrome, Nephritis (Chronic) Uremia without Surgery with Secondary Diagnosis with Age greater than 64
	236	Disease of the Ureter, Nephrotic Syndrome, with Surgical Procedure (Cystoscopy, Biopsy, Other Minor)
	237	Kidney Inflammation and Degenerative Disease (Including Kidney Pelvis) with Surgical Procedure
	238	Disease of the Kidney and Ureter with Surgery (Kidney Removal, Kidney Transplant, Other Major)
55: Urinary Calculus	239	Urinary Stone without Surgery without Secondary Diagnosis
	240	Urinary Stone without Surgery with Secondary Diagnosis.
	241	Urinary Stone with Surgical Procedure (Visualization, Catheter to Kidney Other)
	242	Urinary Stone with Surgery (Incision and Drainage of Kidney, Bladder, Ureter and Other Major)
56: Cystitis and Other Urinary Diseases	243	Bladder Inflammation with Other Urinary Disease without Surgery without Secondary Diagnosis
	244	Inflammation of the Bladder and Urethra with Narrowing of the Urethra without Surgery with Secondary Diagnosis
	245	Bladder (Abnormal Passage, Pouching, Other Disease) without Surgery with Secondary Diagnosis with Age less than 46
	246	Bladder (Abnormal Passage, Pouching, Other Disease) without Surgery with Secondary Diagnosis with Age greater than 45
	247	Disease of the Bladder and Urethra with Surgical Procedure (Visualization, Opening
	248	Disease of the Bladder and Urethra with Surgical Procedure (Visualization, Excision, Dilatation, Repair) with Age less than 15
	249	Disease of the Bladder and Urethra with Surgical Procedure (Visualization, Excision, Dilatation, Repair) with Age greater than 14
	250	Disease of the Bladder and Urethra with Surgery (Removal of Bladder, Removal of Prostate, Other Major)
57: Disease of the Prostate	251	Disease of the Prostate without Surgery
	252	Disease of the Prostate with Surgical Procedure (Bladder Visualization, Dilatation of Urethra, Biopsy) without Secondary Diagnosis
	253	Disease of the Prostate with Surgical Procedure (Bladder Visualization, Dilatation of Urethra, Biopsy) with Secondary Diagnosis
	254	Disease of the Prostate with Surgery (Non-Incisional Removal of Prostate) without Secondary Diagnosis
	255	Disease of the Prostate with Surgery (Non-Incisional Removal of Prostate) with Secondary Diagnosis
	256	Disease of the Prostate with Surgery (Incisional Removal of the Prostate)

: Disease of the Male Reproductive System	257	Excessive Foreskin over the Glans Penis with Surgery
	258	Disease of the Male Reproductive System Except Circumcision without Surgery
	259	Disease of the Male Reproductive System Except Circumcision with Surgery with Age less than 45
	260	Disease of the Male Reproductive System Except Circumcision with Surgery with Age greater than 44
: Disease of the Female Reproductive System	261	Disorder of Menstruation without Surgery
	262	Disease of the Female Reproductive System Except Disorder of Menstruation without Secondary Diagnosis
	263	Disease of the Female Reproductive System Except Disorder of Menstruation with Secondary Diagnosis
	264	Disease of the Female Reproductive System with Surgical Procedures (D&C, Visualization, Removal Fallopian Tubes) without Secondary Diagnosis
	265	Disease of the Female Reproductive System with Surgical Procedure (D&C, Visualization, Other) with Secondary Diagnosis
	266	Disease of the Female Reproductive System with Surgery (Removal of Womb, Repair of Female Reproductive Organ, Other Major)
0: Diseases of the Breast	267	Benign Breast Tumor, Chronic Cystic Disease without Secondary Diagnosis
	268	Acute Inflammation of the Breast, Enlarged Breast without Secondary Diagnosis
	269	Disease of the Breast with Secondary Diagnosis with Age less than 56
	270	Disease of the Breast with Secondary Diagnosis with Age greater than 55
1: Abortion	271	Abortion without Secondary Diagnosis
	272	Abortion with Secondary Diagnosis
2: Obstetrical Diseases of the Antepartum and Puerperium	273	False Labor without Surgery
	274	Threatened Abortion Premature Separation of the Afterbirth, Other Hemorrhage During Pregnancy without Surgery
	275	Obstetrical Complications, Poisons in Blood, Excessive Vomiting, Blood Clot Vein-Extremity without Surgery
	276	Obstetrical Disease Before and After Delivery with Surgical Procedure (D&C, Repair of Neck of Womb)
	277	Obstetrical Disease Before and After Delivery with Surgery (Removal of Tubes and Ovaries, Other Major)
63: Normal Delivery	278	Delivery without Surgery or with Surgery Assisting Delivery
	279	Delivery with Tying of Tubes, Removal of Tubes
	280	Delivery with Cesarean Section
64: Delivery with Complications	281	Delivery with Complications without Surgery or with Surgery Assisting Delivery
	282	Delivery with Complications with Cesarean Section
65: Diseases of the Skin and Subcutaneous Tissue	283	Excessive Scar Tissue, Excessive Pigment, Fatty Cyst, Other Minor Skin Disease without Secondary Diagnosis
	284	Excessive Scar Tissue, Excessive Pigment, Fatty Cyst, Other Minor Skin Disease with Secondary Diagnosis
	285	Skin Inflammation, Abscess, Eczema, Chronic Ulcer without Surgery with Age less than 21
	286	Skin Inflammation, Abscess, Eczema, Chronic Ulcer without Surgery with Age greater than 20
	287	Skin Inflammation, Abscess, Eczema, Reddened Skin with Surgery without Secondary Diagnosis
	288	Skin Inflammation, Abscess, Eczema, Reddened Skin with Surgery with Secondary Diagnosis
	289	Psoriasis, Eruptive Skin Lesions, Chronic Skin Ulcer

	Arthritis	290	Arthritis without Surgery with Age less than 65
		291	Arthritis without Surgery with Age greater than 64
		292	Arthritis with Surgery (Excision of Bone, Joint, Membrane Surgical Joint Fixation)
		293	Arthritis with Surgery (Joint Incision, Spinal Fusions, Excision of Tissue Between Vertebrae)
		294	Arthritis with Surgery (Repair and Restoration of Joint, Removal of Membrane between Vertebrae)
67:	Derangement and Displacement of Intervertebral Disc	295	Disorder and Displacement of Disc Between Vertebrae without Surgery
		296	Disorder and Displacement of Disc Between Vertebrae with Surgery
68:	Diseases of the Bone and Cartilage	297	Rheumatism and Inflammation Tissue Covering Bone, Other Minor Bone Disease without Surgery
		298	Disease of the Bone, Inflammation of Marrow (Acute, Chronic), Spongy Bone, Unaided Fracture without Surgery
		299	Disease of the Bone, and Bone Tissue Lining, with Surgery (Excision Bone Lining, Repair of Other Joint)
		300	Disease of the Bone and Bone Tissue Lining with Surgery (Joint Incision, Bone Excision, Bone Fusion)
		301	Disease of the Bone and Bone Tissue Lining with Surgery (Amputation, Hip Restoration, Other Major)
69:	Other Disease of the Musculo-Skeletal System	302	Inflammation of the Component Parts of the Joints, Curvature of the Spine, Deformed Foot without Surgery
		303	Backache, Diffuse Disease of Connective Tissue, Inflammation of Muscle without Surgery without Secondary Diagnosis
		304	Backache, Diffuse Disease of Connective Tissue, Inflammation of Muscle without Surgery with Secondary Diagnosis
		305	Inflammation of the Component Parts of Joinos with Deformity (Palm, Finger, Toe) with Surgery
		306	Other Disease of the Muscle and Bone (Major) with Surgical Procedure
		307	Other Disease of the Muscle and Bone (Major) with Surgery (Removal, Repair of the Small Joint, Bone)
		308	Other Disease of the Muscle and Bone (Major) with Surgery (Joining Vertebrae, Other)
70:	Congenital Anomalies	309	Birth Defect (Bone, Stomach, Testicle) without Surgery
		310	Birth Defect (Heart, Kidney, Other Major) without Surgery
		311	Birth Defect (Testicle, Skin, Stomach, Other Minor) with Surgery
		312	Birth Defect (Heart Valve, Other Unspecified Heart Site) with Surgical Procedure (Cardiac Catheterization)
		313	Birth Defect (Palate, Lip, Hip or Other Extremity) with Surgery (Repair of Mouth, Fixation of Hip)
		314	Birth Defect (Heart Valve, Other Unspecified Site) with Surgery (Heart Valve, Septal Repair)
		315	Congenital Diseases (Tetralogy of Fallot, Atrial Septal Defect, Hypospadia, Other) with Surgical Procedure (Catheterization, Repair of Urethra)
		316	Congenital Diseases (Tetralogy of Fallot, Atrial Septal Defect, Other) with Surgery (Valve, Septum, Shunt)
		317	Birth Defect (Spine, Gullet, Large Bowel) with Surgery
71:	Normal Mature Newborn	318	Normal Full Term Newborn
72:	Certain Diseases and Conditions Peculiar to Newborn Infants	319	Well Baby Care (Pregnancy greater than 9 months), Other Minor Disease or Condition of the Newborn Infant
		320	Immaturity, Hyaline Membrane Disease, Other Major Disease or Condition of the Infant without Secondary Diagnosis
		321	Immaturity, Hyaline Membrane Disease, Other Major Disease or Condition of the Infant with Secondary Diagnosis

73: Signs and Symptoms Pertaining to the Nervous, Respiratory, and Circulatory Systems	322	Indications of Nervous, Respiratory, Circulatory System Disease without Surgery without Secondary Diagnosis
	323	Convulsions, Fainting, Nosebleed, Chest Pain without Surgery with Secondary Diagnosis
	324	Brain Disorder of Dizziness, Shortness of Breath, Coughing up Blood without Surgery with Secondary Diagnosis
	325	Indications of Nervous, Respiratory, Circulatory System Disease with Surgical Procedu
	326	Indications of Nervous, Respiratory, Circulatory System Disease with Major Surgery
74: Signs and Symptoms Pertaining to the Gastro-Intestinal and Urinary Systems	327	Indications of Gastro-Intestinal, Urinary System Disease without Surgery without Secondary Diagnosis
	328	Indications of Gastro-Intestinal, Urinary System Disease without Surgery with Secondary Diagnosis
	329	Indications of Gastro-Intestinal, Urinary System Disease with Surgical Procedure (Visual Inspection, Other)
	330	Indications of Gastro-Intestinal, Urinary System Disease with Surgery (Abdominal, Other Major)
75: Miscellaneous Signs, Symptoms, and Ill-Defined Conditions	331	Sterility (Male, Female), Admission for Observation without Surgery
	332	Chemical Imbalance, Headache, Fever, Other Ill-Defined Indication of Disease without Surgery with Age less than 15
	333	Chemical Imbalance, Headache, Fever, Other Ill-Defined Indication of Disease without Surgery with Age greater than 14
	334	Miscellaneous Indication of Disease with Surgical Procedure (Visual Inspection, Other)
	335	Miscellaneous Indication of Disease with Surgery (Abdominal Surgery, Removal of Uterus, Other Major)
76: Fractures	336	Fracture (Skull, Face, Forearm, Leg, Foot, Hand) without Surgery with Age less than 30
	337	Fracture (Skull, Face, Forearm, Leg, Foot, Hand) without Surgery with Age greater than 29
	338	Fracture (Spine, Ribs, Bone of the Upper Arm) without Surgery with Age less than 65
	339	Fracture (Spine, Ribs, Bone of the Upper Arm) without Surgery with Age greater than 64
	340	Fracture (Thigh Bone, Pelvis, Multiple) without Surgery
	341	Fracture (Nose, Forearm, Hand, Lower Leg, Foot) with Surgical Procedure (Closed Reduction) without Secondary Diagnosis
	342	Fracture (Nose, Forearm, Hand, Lower Leg, Foot) with Surgical Procedure (Closed Reduction) with Secondary Diagnosis
	343	Fracture (Lower Jaw, Upper Arm, Ankle) with Surgical Procedure (Closed Reduction, Open Reduction of Face) without Secondary Diagnosis
	344	Fracture (Lower Jaw, Upper Arm, Ankle) with Surgical Procedure (Closed Reduction, Open Reduction of Face) with Secondary Diagnosis
	345	Fracture (Arm, Hand, Foot, Shoulder Blade) with Surgery (Open Reduction, External Fixation, Other)
	346	Fracture(Ankle, Leg Bones) with Surgery (Open Reduction, External Fixation, Other)
	347	Fracture (Thigh Bone, Pelvis) with Surgery (Open Reduction, External Fixation, Other)
	348	Fracture with Major Surgery (Amputation, Restoration of Hip Joint, Other Major)
77: Dislocations and Other Musculo-Skeletal Injuries	349	Dislocation (Shoulder, Elbow, Wrist, Knee), Sprains (Ankle, Foot, Hand) without Surgery
	350	Dislocation (Jaw, Hip), Sprains (Knee, Scroiliac, Other Unspecified) without Surgery
	351	Dislocation (Shoulder, Elbow, Hand), Sprains (Elbow, Wrist, Hand) with Surgery
	352	Dislocation (Knee, Ankle), Sprains (Shoulder, Knee, Ankle) with Surgery
	353	Dislocation (Hip, Multiple), Sprains (Hip, Sacroiliac, Other Unspecified) with Surgery

8: Internal Injuries of the Cranium, Chest, and Other Organs	354	Internal Injury of the Skull, Other Organ without Surgery without Secondary Diagnosis with Age less than 41
	355	Internal Injury of the Skull, Other Organ without Surgery with Secondary Diagnosis with Age less than 41
	356	Internal Injury of the Skull, Other Organ without Surgery with Age greater than 40
	357	Internal Injury with Surgical Procedure (Suture of Skin, Nerve, Nerve Repair, Other)
	358	Internal Injury with Surgery (Removal of Spleen, Drainage of Chest Cavity, Excision of Skin)
	359	Internal Injury with Surgery (Opening of Skull, Exploration of Abdominal Cavity)
9: Open Wounds and Superficial Injuries	360	Open Wound (Uncomplicated), Superficial Injury, Foreign Body without Surgery
	361	Open Wound (Complicated), Bruise, Multiple Injuries without Surgery without Secondary Diagnosis
	362	Open Wound (Complicated), Bruise, Multiple Injuries without Surgery with Secondary Diagnosis
	363	Open Wound (External), Foreign Body with Surgical Procedure (Visualization, Suturing, Other)
	364	Open Wound (Complicated) of the Head, Multiple Sites with Surgical Procedure (Visualization, Suturing, Other)
	365	Open Wound (External), Superficial Injury with Surgery (Excision, Other Major)
	366	Open Wound (Complicated) of the Head, Multiple Sites with Surgery (Excision, Other Major)
80: Burns	367	Burn of the 1st Degree (Uncomplicated) Covering less than 20% of the Body
	368	Burn of the 2nd Degree (Complicated), 3rd Degree Covering more than 20% of the Body
81: Complications of Medical and Surgical Care	369	Complications of Medical or Surgical Care without Surgery without Secondary Diagnosis
	370	Complications of Medical or Surgical Care without Surgery with Secondary Diagnosis
	371	Complications of Medical or Surgical Care with Surgical Procedure
	372	Complications of Medical or Surgical Care with Surgery (Replacement of Heart Device, Repair of Stomach)
	373	Complications of Medical or Surgical Care with Surgery (Revision of Shunt, Other Major)
82: Adverse Effects of Certain Substances	374	Adverse Effect of a Drug, Toxic Effect of Alcohol without Secondary Diagnosis
	375	Adverse Effect of a Drug, Toxic Effect of Alcohol with Secondary Diagnosis
	376	Toxic Effect (Lead, Acid, Alkali, Carbon Monoxide, Radiation) without Secondary Diagnosis
	377	Toxic Effect (Lead, Acid, Alkali, Carbon Monoxide, Radiation) with Secondary Diagnosis
83: Special Admissions and Examinations without Reported Diagnoses	378	Prenatal Care, Medical and Surgical after Care (Dialysis) without Surgery
	379	Admission for Sterilization, Chemotherapy, Radiation Therapy without Surgery
	380	Follow up (Cancer) Surgery, Medical after Care (Colostomy, Orthopedic, Other) without Surgery
	381	Special Admission with Surgery (Sterilization, D&C, Other)
	382	Special Admission with Surgical Procedure (Bladder Visualization, Removal of Fixed Internal Device)
	383	Special Admission with Surgery (Exploration of Abdominal Cavity, Removal of Uterus, Other Major)

Appendix B

Diagnosis Related Group Reports
for PSRO Databases

April 1978

1.0 Introduction

The Diagnosis Related Group (DRG) Reports present displays and data summaries for a PSRO or a single hospital based on the individual groups in the AUTOGRP Patient Classification Scheme for Length of Stay. The classification scheme was developed at the Center for the Study of Health Services, Yale University, using an interactive descriptive data analysis system called AUTOGRP.* Under this scheme, the entire range of diagnosis codes are partitioned into 83 broad categories (Major Diagnostic Categories) which are, in most cases, further broken down into subgroups based on those variables determined to be important in predicting length of stay (i.e., primary diagnosis, secondary diagnosis, primary surgery, secondary surgery, age, and in one DRG the presence of psychiatric service). This set of reports includes:

Casemix Index Report

PSRO (Region) Reports
    General Statistics
    LOS Statistics by DRG Number
    Bed Day Statistics by DRG Number
    Cumulative Percent of Discharges by DRG
    Cumulative Percent of Bed Days by DRG

Hospital Percentiles by DRG (Rank Report)

The PSRO (region) reports can be generated from a database representing the PSRO as a whole, a subset of the hospitals, or an individual hospital. Moreover, the PSRO has the option to specify a subset of the DRGs on which to run the reports.

Each of these reports is described on the following pages. In all of the reports statistics on the patient population are presented for "outliers" and "non-outliers". That is, for each DRG, patients are divided into two categories based on their length of stay. Those with a length of stay greater than a predetermined "trim point" for the DRG are classified as "outliers". The remainder are "non-outliers". A list of the DRGs and specified trim points appears in Appendix A. In some of the reports, an additional subpopulation is identified — "deaths". This group is composed of all observations with a discharge status code of dead.

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*Mills, R., Fetter, R., Riedel, D. and Averill, R.: "AUTOGRP: An Interactive Computer System for the Analysis of Health Care Data." Medical Care, Vol. 14, No. 7, 603-615.

As indicated above there are 383 Diagnosis Related Groups which were formed from an initial set of 83 Major Diagnostic Categories. For reporting purposes three other DRGs are presented in these reports. They are DRGs 384, 385, and 386 corresponding to cases classified as ungroupables, outliers, and deaths. Outliers and deaths were described above. Ungroupables are those observations which could not be classified into a DRG because either the primary diagnosis was missing on the record or the primary diagnosis was not a valid code.

2.0 Casemix Index Report

The basic purpose for the development of a casemix index is to provide a composite measure of the relative complexity of the mix of patients treated at a particular institution. Ultimately, the casemix index could be used as one adjustment factor in determining the appropriate level of resources to be allocated to individual institutions. Given that the complete patient population can be partitioned into diagnosis related patient groups[*] (DRG's) which are homogeneous and stable with respect to their consumption of hospital resources, the casemix of an institution may then be expressed in terms of the relative number of patients in each DRG. In order to reduce the description of casemix from a vector of the number of patients in each DRG to a single scalar measure of casemix, it is necessary to assign weights to each DRG which reflect the relative resource consumption of each. The relative resource consumption of a DRG may be measured by a number of statistics such as total patient days, total charges, ancillary service charges, or total cost. In utilizing any of the above statistics to establish the relative resource consumption weights for the DRG's, three factors must be taken into account.

1. (1) the ability of the statistic to accurately reflect the resource consumption of a DRG
2. (2) the comparability of the statistic across institutions
3. (3) the stability and homogeneity of the statistic across patients within the DRG's

Of course the total cost, properly defined, would be the most promising statistic to measure the resource consumption of the DRG's, but accurate cost information is at present not readily available in the hospital setting. Using various charge statistics or total bed days are realistically the best and most manageable approximations to the resource consumption of the DRG's currently available. The second of the above factors applies primarily in the use of charge statistics. Due to the considerable variation across institutions in the charges levied for similiar services, it would be necessary to adjust for institutional differences in charging practices before they could be used as a relative resource consumption measure. The third factor applies to all the possible statistics. The average or expected value of the resource consumption statistic in each DRG would be used to obtain the relative weight for each DRG. A few aberrant cases in a DRG can thus have a disproportionate influence on the final weight. It is therefore of critical importance to insure the homogeneity of the statistic within DRG's by eliminating outlier observations from the calculation of the weights. However, if an institution's distribution of outlier observations deviates significantly from other institutions, it will be necessary to adjust its final casemix index to take outliers into account.

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[*] Fetter, R.B.,"Multiple Uses of a Patient Classification System," Sixth Annual Conference, Society for Computer Medicine in Conjunction with Society for Advanced Medical Systems, November 1976

A formulation of a casemix index will now be described. Initially the problem of outlier observations will be ignored, and the index definition expanded to include their effects after we have assurance that the basic index deals effectively with the problem of portraying casemix complexity.

The Construction of a Casemix Index

In constructing this index we first use hospital charges as a measure of the relative complexity of each case. Within each DRG the variance in charges for any one institution is assumed stable in the statistical sense. That is, the within DRG variance is constant over a large set of observations. In order to use such a measure, we must account for the difference in treatment patterns as well as the differences in numbers of patients in each DRG.

If t_{ijk} is the charge for treating the k^{th} patient in DRG j in hospital i, then the average charge for each case type is

$$c_{ij} = \sum_k t_{ijk}/n_{ij} \qquad (n_{ij} > 0) \tag{1}$$

in which n_{ij} is the number of patients of type j treated in hospital i. The proportion of cases of type j treated in hospital i is

$$p_{ij} = n_{ij}/\sum_j n_{ij} \tag{2}$$

Thus, we have a matrix of i institutions by j case types and in each cell a value for c_{ij}, n_{ij}, and p_{ij}.

At the margins of this matrix we have by diagnostic group j

$$c_{\cdot j} = \sum_i c_{ij} n_{ij}/\sum_i n_{ij} \tag{3}$$

which is the average charge for treating a case of type j over all institutions, and

$$p_{\cdot j} = \sum_i n_{ij}/\sum_{ij} n_{ij} \tag{4}$$

which is the proportion of cases of type j for all institutions.

Based on the above, we can compute several measures of charges as follows.

$$\gamma_i = \sum_j p_{ij} c_{ij} \tag{5}$$

is the average charge for treating a patient in hospital i. We can standarize case mix by

$$\lambda_i = \sum_j p_{\cdot j} c_{ij} \tag{6}$$

which is the standardized charge per case for hospital i adjusted for case mix. This is the charge which would be experienced in hospital i if it treated a case mix given by the average mix for all institutions being considered in the comparison. There is a problem in computing λ_i since if a particular hospital did not treat at all a particular case type, its charges for that case type would appear to be zero. Thus, the average charge which is predicted for this institution based on the standard case mix would be biased downward to the extent that it simply did not perform at all for certain kinds of cases. In order to neutralize the effect of this bias, it is necessary for any zero valued c_{ij} to insert in that cell the average value, $c_{\cdot j}$, experienced by all institutions in the comparison. Thus, the value of λ_i is an estimate of the costs or charges the hospital would incur if it treated the regional case mix, but adjusted for the regional average cost if it has no experience in treating a particular case type. This is a neutral adjustment which still allows performance comparisons since all institutions in the set being compared are treated alike. We can standardize charges by defining

$$\psi_i = \sum_j p_{ij} c_{\cdot j} \tag{7}$$

which is the standarized charge per case for hospital i adjusted for differences in the charges employed by each hospital in treating a case of type j. This is the charges which would result if the average charges for all hospitals being compared were experienced in treating the case mix of hospital i.

$$\rho = \sum_j p_{\cdot j} c_{\cdot j} \tag{8}$$

is the average charge over the set of hospitals and over all care types for treating a patient. Finally,

$$\alpha_i = \sum_j p_{ij}(\sum_i c_{ij}/H) \tag{9}$$

in which H is the number of hospitals, measures the average charge/case/hospital for hospital i and

$$\beta = \sum_j p_{\cdot j}(\sum_i c_{ij}/H) \tag{10}$$

is the charge/case/hospital if each hospital treated the regional case mix.

The difference between ρ and γ_i can be computed for each DRG as

$$\underset{\text{"total"}}{(p_{ij}c_{ij} - p_j\ c_j)} = \underset{\text{"performance}}{(p_j c_{ij} - p_j c_j)} + \underset{\text{"casemix"}}{(p_{ij}\, c_j - p_j c_j)}$$

$$+ \underset{\text{"interaction"}}{(p_j - p_{ij})\ (c_j - c_{ij})}$$

As can be seen, the interaction term is the product of the difference between proportion of cases treated by the region and the institution in each DRG and the los experienced by the region and the institution in that DRG. The total interaction term is the sum of these individual DRG values and can be seen to be positive if proportion and los differences are both positive or both negative. Cancellation of interaction effect overall can only occur if DRG effects are randomly distributed in the same and in opposite directions.

Alternative Indices

In order to compare institutions on relative complexity of case mix, three ingredients are necessary; a measure of complexity such as los or charges per case, an index which reflects the extent to which institutions treat the same patients differently in terms of this measure, and a case mix index which reflects the extent to which each institution treats different patients. Crucial to the construction of such indices is the selection of the standard or reference from which "difference" will be measured. In this approach, we take as the standard the average treatment pattern for all institutions, that is, $c_{\cdot j}$ the average charge of treating a case of type j over all hospitals. An alternative is $\sum_i c_{ij}/H$ which takes each institution's average charge of treatment of a case type as an observation thus weighting each institution once rather than proportionally to the number of cases of that type which it treats. This would eliminate the dominant effect on the "standard" of those institutions which treat most of the cases of a given type, but may unduly weight an institution which has little experience of the given case type.

Using the $c_{\cdot j}$ as the "standard" against which each institution's charges will be compared, we can define a performance index as

$$L_i = \lambda_i/\rho \tag{11}$$

in which we compare the case mix adjusted charge for hospital i with the average charge over all institutions. A value of 1.2 for L_i, for example, would indicate that on the average this institution treats the standard case mix with a 20% higher charge than is experienced over the entire set of institutions being compared. Thus, this index shows relatively the differences in the way in which hospitals treat the same patients.

Similarly, we can define a case mix index as

$$C_i = \psi_i/\rho \tag{12}$$

in which we compare the charge for treating the institution's case mix to the average charge over all institutions. A value of 1.3 for hospital i would indicate that its case mix would incure 30% more charges than would the case mix for all institutions being compared if it experienced the average charge per case type of all these institutions.

If there were B dollars allocated to all the hospitals in a region, for example, the quantity allocated or reimbursed to each hospital would be

$$R_i = n_{i}.C_i \rho \tag{13}$$

That is, each hospital would be allocated a quantity proportional to the number of patients it treats multiplied by its case mix index and the regional average los for treating a case.

Alternatively, we could define a case mix index as

$$C_i' = \alpha_i/\beta_i \tag{14}$$

which is analogous to (12) except that instead of each patient in each hospital constituting an observation in the computation, the average charge experienced by each institution in treating a case of type j constitutes one observation. In this way, the adjustment for the manner in which institutions treat the same patients differently is weighted the same for the hospital which treats 10 cases as that which treats 100 or even 1000 cases. If there are dominant institutions in the treatment of certain cases, this index would adjust for this dominance by assuming that each institution's average charge in treating any given case type is just as valid as any other's regardless of the number of cases treated.

In Figure 1 we present an example of the application of our approach to case mix analysis involving data from 41 hospitals in a single geographic region. For the region the average los was 8.33428 while for individual hospitals it varied from a low of 5.767 to a high of 10.853. The "standard casemix" los is computed by taking the region's case mix as given by the proportion of cases in each DRG and applies each hospital's los for each DRG. Thus, it represents the average los which would have been achieved if each hospital had treated a case mix identical to that treated over the region. Comparison of this measure gives an indication of the extent to which each institution treats the same casemix differently.

Conversely, the "standard performance" los uses the region's average los for each DRG and applies it to the hsopital's actual case mix. Thus, this average represents the los which would have been experienced by each hospital if it had treated each case in each DRG at the average achieved by the region for that DRG. Comparison of this measure shows us the relative complexity of each institutions case mix.

The indices are then computed merely by relating each average to the regional average.

The meaning of such an analysis can be seen most clearly by focussing attention on the differences displayed in columns 9-12 and relating these differences to the adjusted los results. Thus, for example, institution 76 experienced an average los of 9.411 days for a difference of +1.077 (column 9) days over the region. If it had treated the region's case mix, however, it would have had an average los of only 8.537 days (column 4) for a difference of +0.203 days (column 10). If its casemix had been treated at the region's average los per DRG, its los would have been 8.959 (column 5) for a difference of +0.624 days (column 11).

The significance of these differences can be seen even more clearly by noting that the casemix difference of +0.624 represents the difference between the regional average of 8.334 and the result this hospital would have experienced if its casemix had been treated at the regional average los per DRG. Thus, +0.624 days means that it experienced a case mix more "difficult" to treat (more complex in terms of los) than did the region and this much of its difference of 1.077 days (column 9) with the region is accounted for by case mix. If this difference is added to the regional average of 8.334 we obtain the "standard performance" load 8.959.

Its "performance", that is, the amount by which its patients were treated differently than the region's patients is reflected by the +0.203 days difference in column 10. When this difference is added to the region's average los, we obtain the "standard casemix" los of column 4.

Finally, the remainder of the difference between each institution's average los and the region's is given by the "interaction" term of column 12. Mathematically, the total difference is

$$(\gamma_i - \bar{\rho}) = (\lambda_i - \bar{\rho}) + (\psi_i - \rho) + (\rho + \gamma_i - \lambda_i - \psi_i)$$

in which

ρ = average los over all institutions

γ_i = institution's average los

λ_i = average los if institution treated region's case mix

ψ_i = average los if institution experienced region's los

The total difference between the institution's average los (γ_i) and the regional average (ρ) consists of a "performance" difference ($\lambda_i - \rho$), a "casemix" difference ($\psi_i - \rho$), and an "interaction" difference ($\rho + y_i - \lambda_i - \psi_i$).

This last term, the interaction difference can only be interpreted properly by reference to individual differences at the DRG level since it takes on values only by virtue of volume and los differences between those of the given institution and the average over the region which are "abnormal" relatively. For example, if a particular hospital had a much larger proportion of its cases in a particular DRG than did the region and treated these patients with a significantly longer length of stay, then this compound effect would result in a large contribution to the interaction term. If there were no offsetting DRG's, that is, several other DRG's exhibited the same properties relative to the region and there were none or only a minor opposite result, then the final interaction term would be large. It would be positive in the kind of case described above and when DRG's exhibit lower proportions and lower los simultaneously. Only when DRG statistics give opposing results (lower proportion and higher los or higher proportions and lower los) will interaction turn out to be negative.

Thus, it can be seen that it is necessary to look at that subset of DRG's which give rise to interaction when this term is relatively large overall. If the interaction term is small, then virtually all of the difference between regional and institutional los is accounted for by the performance and case mix terms.

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                                        CASE MIX REPORT
                              REGIONS AVERAGE LOS = 8.31428
 (1)     (2)      (3)       (4)          (5)          (6)       (7)       (8)       (9)       (10)      (11)      (12)
                         STANDARD     STANDARD      AVERAGE                        AVERAGE     LOS
                AVERAGE   CASEMIX   PERFORMANCE      LOS     PERFORM   CASEMIX      LOS     PERFORM   CASEMIX   INTERACT
HOSP     CBS      LOS       LOS          LOS         INDEX     INDEX     INDEX     DIFFER    DIFFER    DIFFER    DIFFER

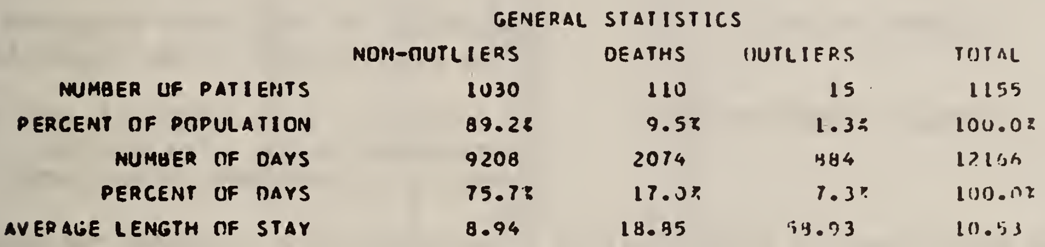
  76    5228     9.411     8.537        9.959        1.129     1.024     1.075     1.077      .203      .624      .250
  78    9212    10.853    10.137        8.936        1.302     1.216     1.072     2.519     1.802      .600      .117
  79    7997     7.929     8.051        9.301         .951      .966      .984     -.405     -.284     -.133      .012
  80     619     6.556     3.318        8.274         .787      .458      .993    -1.779    -4.516     -.056     2.793
  81    1332     8.565     5.992        9.717        1.030      .718     1.156      .249    -2.352     1.382     1.229
  82   12137     6.455     7.372        7.573         .774      .884      .909    -1.880     -.963     -.761     -.156
  84   11237     9.719    11.254        7.453        1.166     1.350      .895     1.315     2.920     -.876     -.659
  87    4756     9.579     9.273        9.395        1.152     1.107     1.062     1.245      .087      .521     -.145
  88    3472     8.425     8.235        8.576        1.013      .589     1.029      .111     -.099      .242     -.032
  89    6413     8.263     7.283        9.153         .992      .874     1.122     -.065    -1.051     1.019     -.033
  95    6231     8.932     9.093        9.094        1.060     1.091      .961      .497      .759     -.328      .057
  96    4026     9.146     8.435        8.917        1.102     1.017     1.070      .852      .100      .583      .169
  97    1761     8.596     8.803        8.135        1.031     1.056      .976      .260      .469     -.199     -.011
  98    3111     8.827     8.072        8.956        1.059      .969     1.075      .493     -.262      .622      .133
 102    5191     7.282     7.153        9.289         .874      .863      .995    -1.053    -1.141     -.046      .134
 105    1403     7.446     5.920        7.904         .893      .711      .936     -.988    -2.497     -.531     2.049
 107    1721     8.644     7.905        8.958        1.037      .945     1.090      .319     -.455      .664      .110
 108    1175     7.410     8.013        7.722         .899      .961      .927     -.924     -.321     -.612      .009
 109    5633     7.222     7.211        9.238         .979      .865      .989    -1.012    -1.123     -.096      .207
 112    3901     8.149     8.227        7.910         .983      .587      .949     -.146     -.107     -.424      .385
 113    1503     6.716     6.312        7.956         .806      .757      .955    -1.618    -2.022     -.379      .783
 114    6322     8.597     9.261        7.737        1.031     1.111      .928      .252      .927     -.597     -.068
 116    6299     8.757     7.562        8.562        1.051      .907     1.027      .422     -.772      .227      .957
 117    9076     9.283     9.752        7.397        1.114     1.050     1.057      .949      .418      .475      .056
 118    5073     7.659     7.322        7.377         .924      .878      .951     -.635    -1.013     -.412      .790
 120    2613     7.575     6.273        9.667         .909      .755     1.039     -.755    -2.041      .313      .973
 121    6159     7.936     8.161        9.756        1.057      .979     1.052      .472     -.174      .432      .214
 122    1325     8.740     8.831        9.240        1.049     1.069      .989      .406      .497     -.094      .003
 123    2436     6.281     6.474        7.414         .754      .777      .990    -2.053    -1.860     -.920      .727
 124    2478     7.537     7.341        9.049         .904      .883      .966     -.797     -.973     -.286      .462
 125    5752     7.550     7.370        7.493         .906      .884      .959     -.794     -.974     -.341      .521
 126    1656     7.995     6.676        9.567         .947      .801     1.009     -.440    -1.659      .073     1.144
 127    6632     7.478     6.863        9.317         .897      .823     1.072     -.856    -1.472      .603      .012
 128    5930     9.912     9.155        9.442        1.189     1.093     1.066     1.577      .821      .547      .209
 129    1035     7.924     6.574        8.661         .951      .789     1.039     -.410    -1.760      .326     1.024
 130    4447     9.072     7.981        9.351        1.089      .559     1.119      .739     -.353      .910      .173
 131    3474     7.999     3.993        7.330         .949     1.028      .980     -.425      .168    -1.004      .410
 132    3537     5.767     6.236        7.321         .692      .749      .842    -2.549    -2.079    -1.313      .843
 133    4655     6.066     6.553        7.744         .729      .786      .932    -2.266    -1.782     -.571      .066
 134    1213     6.393     5.016        7.619         .778      .692      .914    -1.851    -3.419     -.716     2.193
 135    1631     9.713     6.392        9.162        1.165      .767     1.121     1.376    -1.962     1.007     2.310
```

Figure 1

3.0 PSRO (Region) Reports

3.0.1 General Statistics

The General Statistics Report presents selected overall statistics for the total population and the subpopulations corresponding to those cases classified as in DRGs, deaths, and outliers. Sample printout from page 1 of this report appears below in Figure 2.



```
                                    GENERAL STATISTICS
                          NON-OUTLIERS       DEATHS     OUTLIERS        TOTAL
    NUMBER OF PATIENTS            1030          110           15         1155
 PERCENT OF POPULATION           89.2%         9.5%         1.3%       100.0%
        NUMBER OF DAYS            9208         2074          884        12166
       PERCENT OF DAYS           75.7%        17.0%         7.3%       100.0%
AVERAGE LENGTH OF STAY            8.94        18.85        58.93        10.53
```

Figure 2 General Statistics Report

The columns correspond to the different subpopulations:

NON-OUTLIERS	refers to live discharges with lengths of stay at or below the trim points for the DRG in which they are classified (refer to Appendix A for trim points)
DEATHS	refers to those observations with a discharge status of dead
OUTLIERS	refers to those observations with lengths of stay above the trim point for the DRG in which they are classified
TOTAL	refers to the entire population, i.e. the union of the observations classified as non-outliers, deaths, and outliers.

For each of these four subpopulations the following statistics are presented:

NUMBER OF PATIENTS	the number of cases or observations in the subpopulation
PERCENT OF POPULATION	the percent of the database accounted for by the observations in the subpopulation
NUMBER OF DAYS	the number of bed days accounted for by the observations in the subpopulation
PERCENT OF DAYS	the percent of total days accounted for by the observations in the subpopulation
AVERAGE LENGTH OF STAY	the average or mean length of stay for observations in the subpopulation (NUMBER OF DAYS/NUMBER OF PATIENTS)

The second page of this report is a histogram which displays the number, percent and cumulative percent of patients by length of stay. The distribution is graphically illustrated by asterisks (*), where each asterisk represents approximately .75%. Sample print out appears in Figure 3.

3.0.2 LOS Statistics by DRG Number for Live, Non-Outlier Discharges

This report provides statistics for each DRG which contained one or more cases. Cases classified as "deaths" or "outliers" are excluded from the calculation of these statistics. The report can be produced for the PSRO as a whole or for an individual hospital within the PSRO. The rows of the report correspond to the DRGs, ordered in increasing numerical sequence. Sample printout appears in Figure 4. For each DRG the following are presented:

DRG NUM	Diagnosis Related Group number
PATIENTS EXCL	The number of cases classified as deaths or outliers, which are excluded from the remaining statistics

```
HOSP 14
LENGTH OF STAY DISTRIBUTIONS FOR ALL PATIENTS

  ****************************************************************************
    LOS FREQUENCY PERCENT CUMULATIVE

     0       161     13.9%          13.9%   *******************
     1        38      3.3%          17.2%   ****
     2        69      6.0%          23.2%   ********
     3        70      6.1%          29.3%   ********
     4        80      6.9%          36.2%   *********
     5        67      5.8%          42.0%   ********
     6        61      5.3%          47.3%   *******
     7        51      4.4%          51.7%   ******
     8        76      6.6%          58.3%   *********
     9        55      4.8%          63.0%   ******
    10        33      2.9%          65.9%   ****
    11        47      4.1%          70.0%   *****
    12        29      2.5%          72.5%   ***
    13        28      2.4%          74.9%   ***
    14        31      2.7%          77.6%   ***
    15        25      2.2%          79.7%   ***
    16        13      1.1%          80.9%   *
    17        14      1.2%          82.1%   *
    18        17      1.5%          83.5%   **
    19        16      1.4%          84.9%   *
    20        11      1.0%          85.9%   *
    21        13      1.1%          87.0%   *
    22        10       .9%          87.9%   *
    23        14      1.2%          89.1%   *
    24        10       .9%          90.0%   *
    25         8       .7%          90.6%
    26        10       .9%          91.5%   *
    27         8       .7%          92.2%
    28         7       .6%          92.8%
    29         5       .4%          93.2%
    30         3       .3%          93.5%
    31         7       .6%          94.1%
    32         2       .2%          94.3%
    33         4       .3%          94.6%
    34         2       .2%          94.8%
    35         2       .2%          95.0%
    36         4       .3%          95.3%
    37         4       .3%          95.7%
    38         2       .2%          95.8%
    39         5       .4%          96.3%
    40         0       .0%          96.3%
    41         7       .6%          96.9%
    42         4       .3%          97.2%
    43         5       .4%          97.7%
    44         1       .1%          97.7%
    45         3       .3%          98.0%
    46         0       .0%          98.0%
    47         1       .1%          98.1%
    48         1       .1%          98.2%
    49         1       .1%          98.3%
    50         2       .2%          98.4%
    51         2       .2%          98.6%
    52         1       .1%          98.7%
     -
    57         3       .3%          99.0%
    58         1       .1%          99.0%
     -
    61         1       .1%          99.1%
    62         3       .3%          99.4%
     -
    66         1       .1%          99.5%
     -
    69         2       .2%          99.7%
    70         0       .0%          99.7%
    71         1       .1%          99.7%
     -
   102         1       .1%          99.8%
     -
   106         1       .1%          99.9%
     -
   173         1       .1%         100.0%

  ****************************************************************************
```

Figure 3 Histogram Produced with General Statistics Report

```
HOSP
LOS STATISTICS BY DRG NUMBER FOR LIVE, NON-OUTLIER DISCHARGES                                    PAGE 1

DRG --PATIENTS-                                                        DIAGNOSIS RELATED GROUP
NUM EXCL. INCL.  MEAN  S.D. LOW 25%ILE MEDIAN 75%ILE HI CAT
  1    0     2   10.5   7.5   3    3.0    3.0   18.0 18 01 ENTERITIS, DIARRHEAL DIS W AGE<16
  2    0     6    4.8   2.9   0    3.0    4.0    7.0  9 01 ENTERITIS, DIARRHEAL DIS W AGE>15
  3    0    66    3.7   2.6   0    2.0    3.0    5.0 14 01 V.D.,DIS OF VIRAL ORIGIN (ASEPTIC MENINGITIS,WART,OTH) WO DX2
  4    0    87    6.5   5.0   0    4.0    5.0    8.0 25 01 V.D.,DIS OF VIRAL ORIGIN (ASEPTIC MENINGITIS,WART,OTH) W DX2
  5    1    12   11.3  10.8   4    4.0    7.0   12.0 45 01 SEPTICEMIA, T.B., SARCOIDOSIS, SALMONELLA INFECTION WO OPER
  6    2     4   13.5  10.5   2    2.0    4.0   23.0 25 01 SEPTICEMIA, T.B., SARCOIDOSIS, SALMONELLA INFECTION W OPER
  7    6     8   12.4   9.4   3    4.0    8.0   17.0 31 02 CA OF ORAL CAVITY, COLON, GALLBLADDER WO OPER
  8   15     7    8.9   7.2   0     .0   13.0   16.0 17 02 CA OF G-I SYST EXCEPT ORAL CAVITY, COLON,GALLBLADDER WO OPER
  9    1     4    5.5   3.4   2    2.0    4.0    5.0 11 02 CA OF G-I SYST W BIOPSY,ENDOSCOPY, LOCAL EXCSN,OTH MINOR OPER WO DX2
 10    1    11   20.2  16.5   3    8.0   13.0   34.0 57 02 CA OF G-I SYST W BIOPSY,ENDOSCOPY, LOCAL EXCSN,OTH MINOR OPER W DX2
 11    6    59   24.4  11.4   9   15.0   21.0   31.0 51 02 CA OF G-I SYST W EXPLR LAPAROTOMY, RESECTION INTESTINE,OTH MAJOR OPER
 12    3     3    3.7   2.1   1    1.0    4.0    6.0  6 03 CA OF RESP SYSTEM WI OPER WO DX2
 13   12    10   19.7  13.8   2    8.0   16.0   33.0 43 03 CA OF RESP SYSTEM WO OPER W DX2
 14    0     7    4.4   5.8   1    1.0    2.0    6.0 18 03 CA OF RESP SYST W BIOPSY,ENDOSCPY, OTH MINOR OPER WO DX2
 15    1    13   12.7  12.8   0    2.0   12.0   16.0 41 03 CA OF RESP SYST W BIOPSY,ENDOSCPY, OTH MINOR OPER W DX2
 16    2    11   22.8   5.9  12   20.0   23.0   27.0 35 03 CA OF RESP SYST W LOBECTOMY, PNEUMONECTOMY,OTH MAJOR OPER
 17    0     6    1.3   1.6   0     .0     .0    3.0  4 04 CA OF SKIN EXCEPT MALIG MELANOMA WO DX2
 18    0     8   12.1  12.9   0    2.0    7.0    8.0 36 04 CA OF SKIN EXCEPT MALIG MELANOMA W DX2
 20    0     1    1.0    .0   1    1.0    1.0    1.0  1 04 MALIG MELANOMA W DX2
 21    5     6   11.3   7.5   4    5.0    5.0   15.0 25 05 CA OF BREAST WO OPER W AGE<63
 22    5     3   12.3   6.6   5    5.0   11.0   21.0 21 05 CA OF BREAST WO OPER W AGE>62
 23    2     8   10.9   3.1   6    8.0   11.0   11.0 17 05 CA OF BREAST W OPER WO DX2
 24    1    29   12.1   7.2   1    9.0   11.0   13.0 41 05 CA OF BREAST W OPER W DX2
 25    0     1    4.0    .0   4    4.0    4.0    4.0  4 06 CA OF FEMALE GENITAL ORG WO OPER WO DX2
 26    3     2   21.0   5.0  16   16.0   16.0   26.0 26 06 CA OF FEMALE GENITAL ORG WO OPER W DX2
 27    0     8    5.0   1.9   3    3.0    4.0    6.0  8 06 CA OF FEMALE GENITAL ORG W BIOPSY, LOCAL EXCISN,OTH MINOR OPER WO DX2
 28    0     6   11.0  10.1   2    3.0    4.0   23.0 27 06 CA OF FEMALE GENITAL ORG W BIOPSY, LOCAL EXCISN,OTH MINOR OPER W DX2
 29    0     4   14.5   5.0   8    8.0   14.0   14.0 22 06 CA OF UTERUS-CORPUS W HYSTERECTOMY, EXPLR LAPAROTOMY,OTH MAJOR OPER
 30    1     5   11.4   6.3   4    9.0   10.0   11.0 23 06 CA OF UTERUS-CERVIX OVARY W HYSTERECTOMY, OTH MAJOR OPER
 31   11    12    9.2   7.4   0    3.0    7.0   12.0 24 07 CA OF MALE GENITAL ORG WO OPER
 32    0     4   17.3  11.7   8    8.0    9.0   15.0 37 07 CA OF MALE GENITAL ORG W BIOPSY, CYSTOSCOPY,ORCHIECTOMY WO DX2
 33    1     9    7.1   3.3   2    5.0    7.0   10.0 11 07 CA OF MALE GENITAL ORG W BIOPSY, CYSTOSCOPY,ORCHIECTOMY W DX2
 34    3    33   15.6   7.6   6   10.0   13.0   20.0 39 07 CA OF MALE GENITAL ORG W PROSTATECTOMY,OTH MAJOR OPER
```

Figure 4 LOS Statistics by DRG Number for Live, Non-Outlier Discharges

PATIENTS INCL	the number of live, non-outlier cases for which the statistics are calculated
MEAN	the average or mean length of stay
LOW	the lowest or shortest length of stay experienced by any case in the DRG
25% ILE	the 25th percentile (i.e. the day by which 25% of the cases were discharged)
MEDIAN	the 50th percentile (i.e. the day by which 50% of the cases were discharged)
75% ILE	the 75th percentile (i.e. the day by which 75% of the cases were discharged)
HIGH	the highest or longest length of stay experienced by any member of the DRG
CAT	the Major Diagnostic Category of which the DRG is a subset
DIAGNOSIS RELATED GROUP	the abbreviated English description of the DRG

This report can also be produced where several rows of output corresponding to different comparison groups are presented for each DRG. Figure 5 contains sample printout of this report for one hospital in comparison to the PSRO (region).

3.0.3 Bed Day Statistics by DRG Number for all Discharges

This report provides selected statistics for each of the subpopulations - live non-outlier discharges, deaths, and outliers - in addition to the total population. It can be produced for the PSRO as a whole or for an individual hospital within the PSRO. The rows of this report correspond to the DRGs, ordered in increasing numerical sequence. Sample printout appears in Figure 6.

```
HOSP 14
LOS STATISTICS BY DRG NUMBER FOR LIVE, NON-OUTLIER DISCHARGES                                            PAGE 1

                 DRG --PATIENTS-                                                    DIAGNOSIS RELATED GROUP
                 NUM EXCL. INCL.  MEAN  S.D. LOW 25%ILE MEDIAN 75%ILE HI CAT
HOSP 14           1     0     2   10.5   7.5   3   3.0    3.0   18.0  18 01 ENTERITIS, DIARRHEAL DIS W
REGION            *     7  1166    4.1   2.4   0   3.0    4.0    5.0  18      AGE<16

HOSP 14           2     0     6    4.8   2.9   0   3.0    4.0    7.0   9 01 ENTERITIS, DIARRHEAL DIS W
REGION            *    17  1198    5.8   4.5   0   3.0    5.0    7.0  37      AGE>15

HOSP 14           3     0    66    3.7   2.6   0   2.0    3.0    5.0  14 01 V.D.,DIS OF VIRAL ORIGIN (ASEPTIC
REGION            *    33  9465    4.3   3.1   0   2.0    4.0    5.0  26      MENINGITIS,WART,OTH) WO DX2

HOSP 14           4     0    87    6.5   5.0   0   4.0    5.0    8.0  25 01 V.D.,DIS OF VIRAL ORIGIN (ASEPTIC
REGION            *   226 10910    6.3   4.2   0   3.0    5.0    8.0  27      MENINGITIS,WART,OTH) W DX2

HOSP 14           5     1    12   11.3  10.8   4   4.0    7.0   12.0  45 01 SEPTICEMIA, T.B., SARCOIDOSIS,
REGION            *   380  2173   13.1   9.7   0   6.0   10.0   17.0  50      SALMONELLA INFECTION WO OPER

HOSP 14           6     2     4   13.5  10.5   2   2.0    4.0   23.0  25 01 SEPTICEMIA, T.B., SARCOIDOSIS,
REGION            *   111   974   16.7  12.0   0   8.0   14.0   23.0  58      SALMONELLA INFECTION W OPER

HOSP 14           7     6     8   12.4   9.4   3   4.0    8.0   17.0  31 02 CA OF ORAL CAVITY, COLON,
REGION            *   384   591   10.4   8.3   0   5.0    8.0   14.0  44      GALLBLADDER WO OPER

HOSP 14           8    15     7    8.9   7.2   0    .0   13.0   16.0  17 02 CA OF G-I SYST EXCEPT ORAL CAVITY,
REGION            *  1020  1453   11.5   9.6   0   5.0    9.0   15.0  51      COLON,GALLBLADDER WO OPER

HOSP 14           9     1     4    5.5   3.4   2   2.0    4.0    5.0  11 02 CA OF G-I SYST W BIOPSY,ENDOSCPY,
REGION            *    60   766    9.0   8.1   0   3.0    6.0   13.0  42      LOCAL EXCSN,OTH MINOR OPER WO DX2

HOSP 14          10     1    11   20.2  16.5   3   8.0   13.0   34.0  57 02 CA OF G-I SYST W BIOPSY,ENDOSCPY,
REGION            *   267  1277   16.3  12.2   0   7.0   13.0   22.0  62      LOCAL EXCSN,OTH MINOR OPER W DX2

HOSP 14          11     6    59   24.4  11.4   9  15.0   21.0   31.0  51 02 CA OF G-I SYST W EXPLR LAPAROTOMY,
REGION            *   699  4259   23.9  10.8   0  16.0   21.0   30.0  63      RESECTION INTESTINE,OTH MAJOR OPER

HOSP 14          12     3     3    3.7   2.1   1   1.0    4.0    6.0   6 03 CA OF RESP SYSTEM WO OPER WO DX2
REGION            *   272   531    7.0   7.3   0   2.0    5.0    9.0  36

HOSP 14          13    12    10   19.7  13.8   2   8.0   16.0   33.0  43 03 CA OF RESP SYSTEM WO OPER W DX2
REGION            *  1061  1444   13.0  10.4   0   6.0   10.0   17.0  52

HOSP 14          14     0     7    4.4   5.8   1   1.0    2.0    6.0  18 03 CA OF RESP SYST W BIOPSY,ENDOSCPY,
REGION            *    51   667    9.2   8.2   0   3.0    7.0   13.0  38      OTH MINOR OPER WO DX2

HOSP 14          15     1    13   12.7  12.8   0   2.0   12.0   16.0  41 03 CA OF RESP SYST W BIOPSY,ENDOSCPY,
REGION            *   298  1238   16.3  10.7   0   9.0   14.0   21.0  53      OTH MINOR OPER W DX2

HOSP 14          16     2    11   22.0   5.9  12  20.0   23.0   27.0  35 03 CA OF RESP SYST W LOBECTOMY,
REGION            *   231  1432   21.0  10.8   1  13.0   19.0   27.0  62      PNEUMONECTOMY,OTH MAJOR OPER

HOSP 14          17     0     6    1.3   1.6   0    .0     .0    3.0   4 04 CA OF SKIN EXCEPT MALIG MELANOMA
REGION            *    13   905    3.1   3.8   0   1.0    2.0    4.0  32      WO DX2

HOSP 14          18     0     8   12.1  12.9   0   2.0    7.0    8.0  36 04 CA OF SKIN EXCEPT MALIG MELANOMA
REGION            *    33   639    6.9   7.0   0   2.0    4.0    9.0  38      W DX2

HOSP 14          20     0     1    1.0    .0   1   1.0    1.0    1.0   1 04 MALIG MELANOMA W DX2
REGION            *    55   200   11.0   7.9   0   6.0    9.0   15.0  40

HOSP 14          21     5     6   11.3   7.5   4   5.0    5.0   15.0  25 05 CA OF BREAST WO OPER W AGE<63
REGION            *   185   699    9.0   9.2   0   2.0    6.0   13.0  43

HOSP 14          22     5     3   12.3   6.6   5   5.0   11.0   21.0  21 05 CA OF BREAST WO OPER W AGE>62
REGION            *   202   406   12.9   9.7   0   6.0   11.0   17.0  47

HOSP 14          23     2     8   10.9   3.1   6   8.0   11.0   11.0  17 05 CA OF BREAST W OPER WO DX2
REGION            *    62  1678    9.3   3.6   0   7.0    9.0   11.0  20
```

Figure 5 LOS Statistics by DRG Number for Live, Non-Outlier Discharges: Hospital Versus Region Comparison

```
HOSP 14
BED DAY STATISTICS BY DRG NUMBER FOR ALL DISCHARGES                                                          PAGE 1

DRG    ---LIVE DISCHARGES---- -------DEATHS--------   -------OUTLIERS-------   ----TOTAL---- TR  DIAGNOSIS RELATED GROUP
NUM    NUM  %TOT   DAYS  %TOT  NUM %TOT   DAYS %TOT    NUM %TOT   DAYS %TOT   NUMBER   DAYS IM CAT
  1      2 100.0     21 100.0    0   .0      0   .0      0   .0      0   .0        2     21 20 01 ENTERITIS, DIARRHEAL DIS W
                                                                                                    AGE<16
  2      6 100.0     29 100.0    0   .0      0   .0      0   .0      0   .0        6     29 37 01 ENTERITIS, DIARRHEAL DIS W
                                                                                                    AGE>15
  3     66 100.0    245 100.0    0   .0      0   .0      0   .0      0   .0       66    245 26 01 V.D.,DIS OF VIRAL ORIGIN (ASEPTIC
                                                                                                    MENINGITIS,WART,OTH) WO DX2
  4     87 100.0    562 100.0    0   .0      0   .0      0   .0      0   .0       87    562 27 01 V.D.,DIS OF VIRAL ORIGIN (ASEPTIC
                                                                                                    MENINGITIS,WART,OTH) W DX2
  5     12  92.3    135  99.3    1  7.7      1   .7      0   .0      0   .0       13    136 50 01 SEPTICEMIA, T.B., SARCOIDOSIS.
                                                                                                    SALMONELLA INFECTION WO OPER
  6      4  66.7     54  22.1    2 33.3    190 77.9      0   .0      0   .0        6    244 58 01 SEPTICEMIA, T.B., SARCOIDOSIS.
                                                                                                    SALMONELLA INFECTION W OPER
  7      8  57.1     99  40.6    5 35.7     83 34.0      1  7.1     62 25.4       14    244 44 02 CA OF ORAL CAVITY, COLON,
                                                                                                    GALLBLADDER WO OPER
  8      7  31.8     62  24.4   15 68.2    192 75.6      0   .0      0   .0       22    254 51 02 CA OF G-I SYST EXCEPT ORAL CAVITY,
                                                                                                    COLON,GALLBLADDER WO OPER
  9      4  80.0     22  44.9    1 20.0     27 55.1      0   .0      0   .0        5     49 42 02 CA OF G-I SYST W BIOPSY,ENDOSCOPY,
                                                                                                    LOCAL EXCSN,OTH MINOR OPER WO DX2
 10     11  91.7    222  91.7    1  8.3     20  8.3      0   .0      0   .0       12    242 62 02 CA OF G-I SYST W BIOPSY,ENDOSCOPY,
                                                                                                    LOCAL EXCSN,OTH MINOR OPER W DX2
 11     59  90.8   1437  85.0    4  6.2     86  5.1      2  3.1    168  9.9       65   1691 63 02 CA OF G-I SYST W EXPLR LAPAROTOMY,
                                                                                                    RESECTION INTESTINE,OTH MAJOR OPER
 12      3  50.0     11  18.0    3 50.0     50 82.0      0   .0      0   .0        6     61 37 03 CA OF RESP SYSTEM WO OPER WO DX2

 13     10  45.5    197  63.8   12 54.5    112 36.2      0   .0      0   .0       22    309 52 03 CA OF RESP SYSTEM WO OPER W DX2

 14      7 100.0     31 100.0    0   .0      0   .0      0   .0      0   .0        7     31 38 03 CA OF RESP SYST W BIOPSY,ENDOSCPY,
                                                                                                    OTH MINOR OPER WO DX2
 15     13  92.9    165  92.2    1  7.1     14  7.8      0   .0      0   .0       14    179 54 03 CA OF RESP SYST W BIOPSY,ENDOSCPY,
                                                                                                    OTH MINOR OPER W DX2
 16     11  84.6    251  84.5    2 15.4     46 15.5      0   .0      0   .0       13    297 62 03 CA OF RESP SYST W LOBECTOMY,
                                                                                                    PNEUMONECTOMY,OTH MAJOR OPER
 17      6 100.0      8 100.0    0   .0      0   .0      0   .0      0   .0        6      8 32 04 CA OF SKIN EXCEPT MALIG MELANOMA
                                                                                                    WO DX2
 18      8 100.0     97 100.0    0   .0      0   .0      0   .0      0   .0        8     97 31 04 CA OF SKIN EXCEPT MALIG MELANOMA
                                                                                                    W DX2
 20      1 100.0      1 100.0    0   .0      0   .0      0   .0      0   .0        1      1 42 04 MALIG MELANOMA W DX2

 21      6  54.5     68  45.6    5 45.5     81 54.4      0   .0      0   .0       11    149 43 05 CA OF BREAST W. OPER W AGE<70

 22      3  37.5     37  24.0    4 50.0     60 39.0      1 12.5     57 37.0        8    154 48 05 CA OF BREAST WO OPER W AGE>69

 23      8  80.0     87  65.4    1 10.0     18 13.5      1 10.0     28 21.1       10    133 20 05 CA OF BREAST W OPER WO DX2
```

Figure 6 Bed Day Statistics by DRG Number for
All Discharges

For each DRG, the following statistics are presented:

DRG NUM	Diagnosis Related Group Number

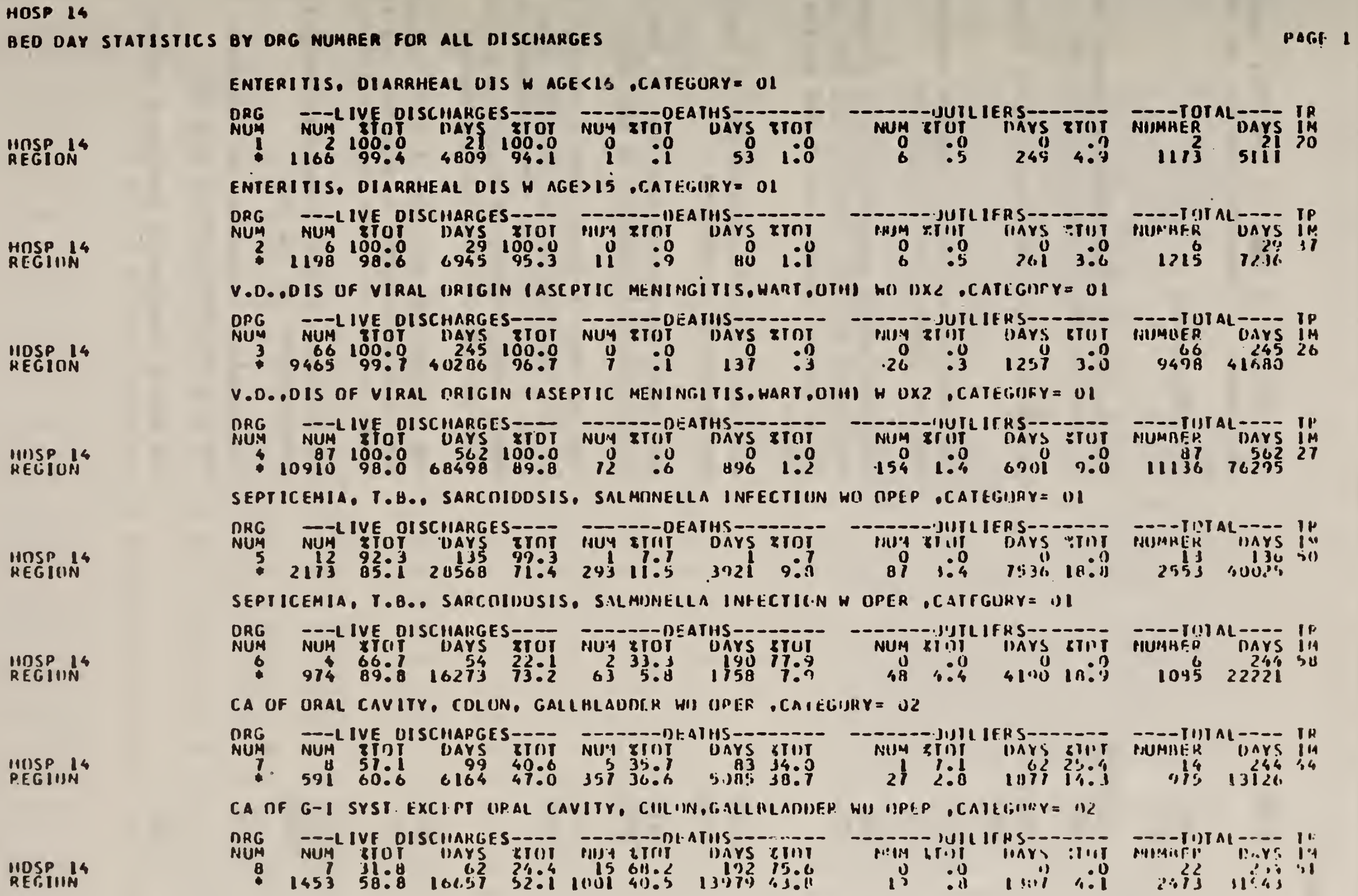
For live non-outlier discharges, deaths, and outliers:

NUM	the number of observations
% TOT	the precent of the total population of the DRG accounted for by NUM
DAYS	the bed days accounted for by the NUM cases
% TOT	the percent of the total days used by all patients in the DRG, accounted for by DAYS
TOTAL NUMBER	total number of observations in the DRG (i.e. NUM live non-outlier discharges + NUM deaths + NUM outliers)
TOTAL DAYS	total days accounted for by the TOTAL NUMBER of observations (i.e. live non-outlier DAYS + death DAYS + outlier DAYS)
TRIM	the trim point for the DRG. (Cases with a length of stay greater than this trim point are classified as "outliers" for the DRG)

This report can also be produced where several rows of output corresponding to different comparison groups are presented for each DRG. Figure 7 contains sample printout of this report for one hospital in comparison to the PSRO (region).

3.0.4 Cumulative Percent of Discharges by DRG

This report presents frequency counts and bed day statistics for each DRG, ordered in decreasing sequence by the number of patients included in the DRG. It can be produced for the PSRO as a whole or for an individual hospital within the PSRO. The rows of this report correspond to the DRGs. Sample



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HOSP 14
BED DAY STATISTICS BY DRG NUMBER FOR ALL DISCHARGES                                                   PAGE 1

                 ENTERITIS, DIARRHEAL DIS W AGE<16 ,CATEGORY= 01

                 DRG    ---LIVE DISCHARGES----  --------DEATHS--------   --------OUTLIERS--------  ----TOTAL---- TR
                 NUM     NUM  %TOT    DAYS  %TOT  NUM %TOT    DAYS %TOT      NUM %TOT    DAYS %TOT  NUMBER   DAYS IM
HOSP 14            1       2 100.0      21 100.0    0   .0       0   .0        0   .0       0   .0       2     21 70
REGION             *    1166  99.4    4809  94.1    1   .1      53  1.0        6   .5     249  4.9    1173   5111

                 ENTERITIS, DIARRHEAL DIS W AGE>15 ,CATEGORY= 01

                 DRG    ---LIVE DISCHARGES----  --------DEATHS--------   --------OUTLIERS--------  ----TOTAL---- TR
                 NUM     NUM  %TOT    DAYS  %TOT  NUM %TOT    DAYS %TOT      NUM %TOT    DAYS %TOT  NUMBER   DAYS IM
HOSP 14            2       6 100.0      29 100.0    0   .0       0   .0        0   .0       0   .0       6     29 37
REGION             *    1198  98.6    6945  95.3   11   .9      80  1.1        6   .5     261  3.6    1215   7286

                 V.D.,DIS OF VIRAL ORIGIN (ASEPTIC MENINGITIS,WART,OTH) WO DX2 ,CATEGORY= 01

                 DRG    ---LIVE DISCHARGES----  --------DEATHS--------   --------OUTLIERS--------  ----TOTAL---- TR
                 NUM     NUM  %TOT    DAYS  %TOT  NUM %TOT    DAYS %TOT      NUM %TOT    DAYS %TOT  NUMBER   DAYS IM
HOSP 14            3      66 100.0     245 100.0    0   .0       0   .0        0   .0       0   .0      66    245 26
REGION             *    9465  99.7   40286  96.7    7   .1     137   .3       26   .3    1257  3.0    9498  41680

                 V.D.,DIS OF VIRAL ORIGIN (ASEPTIC MENINGITIS,WART,OTH) W DX2 ,CATEGORY= 01

                 DRG    ---LIVE DISCHARGES----  --------DEATHS--------   --------OUTLIERS--------  ----TOTAL---- TR
                 NUM     NUM  %TOT    DAYS  %TOT  NUM %TOT    DAYS %TOT      NUM %TOT    DAYS %TOT  NUMBER   DAYS IM
HOSP 14            4      87 100.0     562 100.0    0   .0       0   .0        0   .0       0   .0      87    562 27
REGION             *   10910  98.0   68498  89.8   72   .6     896  1.2      154  1.4    6901  9.0   11136  76295

                 SEPTICEMIA, T.B., SARCOIDOSIS, SALMONELLA INFECTION WO OPER ,CATEGORY= 01

                 DRG    ---LIVE DISCHARGES----  --------DEATHS--------   --------OUTLIERS--------  ----TOTAL---- TR
                 NUM     NUM  %TOT    DAYS  %TOT  NUM %TOT    DAYS %TOT      NUM %TOT    DAYS %TOT  NUMBER   DAYS IM
HOSP 14            5      12  92.3     135  99.3    1  7.7       1   .7        0   .0       0   .0      13    136 50
REGION             *    2173  85.1   28568  71.4  293 11.5    3921  9.8       87  3.4    7536 18.8    2553  40025

                 SEPTICEMIA, T.B., SARCOIDOSIS, SALMONELLA INFECTION W OPER ,CATEGORY= 01

                 DRG    ---LIVE DISCHARGES----  --------DEATHS--------   --------OUTLIERS--------  ----TOTAL---- TR
                 NUM     NUM  %TOT    DAYS  %TOT  NUM %TOT    DAYS %TOT      NUM %TOT    DAYS %TOT  NUMBER   DAYS IM
HOSP 14            6       4  66.7      54  22.1    2 33.3     190 77.9        0   .0       0   .0       6    244 58
REGION             *     974  89.8   16273  73.2   63  5.8    1758  7.9       48  4.4    4190 18.9    1095  22221

                 CA OF ORAL CAVITY, COLON, GALLBLADDER WO OPER ,CATEGORY= 02

                 DRG    ---LIVE DISCHARGES----  --------DEATHS--------   --------OUTLIERS--------  ----TOTAL---- TR
                 NUM     NUM  %TOT    DAYS  %TOT  NUM %TOT    DAYS %TOT      NUM %TOT    DAYS %TOT  NUMBER   DAYS IM
HOSP 14            7       8  57.1      99  40.6    5 35.7      83 34.0        1  7.1      62 25.4      14    244 44
REGION             *     591  60.6    6164  47.0  357 36.6    5085 38.7       27  2.8    1877 14.3     975  13126

                 CA OF G-I SYST EXCEPT ORAL CAVITY, COLON,GALLBLADDER WO OPER ,CATEGORY= 02

                 DRG    ---LIVE DISCHARGES----  --------DEATHS--------   --------OUTLIERS--------  ----TOTAL---- TR
                 NUM     NUM  %TOT    DAYS  %TOT  NUM %TOT    DAYS %TOT      NUM %TOT    DAYS %TOT  NUMBER   DAYS IM
HOSP 14            8       7  31.8      62  24.4   15 68.2     192 75.6        0   .0       0   .0      22    254 51
REGION             *    1453  58.8   16657  52.1 1001 40.5   13979 43.8       19   .8    1307  4.1    2473  31943
```

Figure 7 Bed Day Statistics by DRG Number for All Discharges: Hospital Versus Region Comparison

printout appears in Figure 8. For each DRG, the following Statistics are presented:

RANK	the sequential rank of the DRG, based on the number of observations in the DRG
DRG NUM	the DRG number
PATIENTS EXCL.	the number of observations classified as deaths and outliers in the DRG
PATIENTS INCL.	the number of live non-outlier discharges
PCT PTS	the percent of all discharges accounted for by observations in the DRG
CUM PCT	the cumulative percent of all discharges accounted for by those in the DRG and those listed prior to the DRG in this report
DAYS EXCL.	the total days accounted for by the deaths and outliers in the DRG
DAYS INCL.	the total days accounted for by the live non-outlier discharges in the DRG
PCT DAYS	the percent of total days accounted for by all observations in the DRG (i.e. (DAYS EXCL. + DAYS INCL.)/ TOTAL NUMBER OF DAYS, where TOTAL NUMBER OF DAYS can be obtained from the General Statistics Report)
CUM PCT	the cumulative percent of days accounted for by observations in the DRG and in those listed prior to the DRG in this report
LOS MEAN	the average or mean length of stay for all observations in the DRG
S.D.	the standard deviation of length of stay for all observations in the DRG
CAT	the Major Diagnostic Category number

HOSP 14

CUMULATIVE PERCENT OF DISCHARGES BY DRG

PAGE 1

RANK	DRG NUM	--PATIENTS- EXCL.	INCL.	PCT PTS	CUM PCT	----DAYS---- EXCL.	INCL.	PCT DAYS	CUM PCT	LOS. MEAN	S.D.	CAT	DIAGNOSIS RELATED GROUP
1	77	0	110	9.52	9.5	0	2074	17.05	17.0	18.9	.0	**	DEATHS
2	4	0	87	7.53	17.1	0	562	4.62	21.7	6.5	5.0	01	V.D.,DIS OF VIRAL ORIGIN (ASEPTIC MENINGITIS,WART,OTH) W DX2
3	3	0	66	5.71	22.8	0	245	2.01	23.7	3.7	2.6	01	V.D.,DIS OF VIRAL ORIGIN (ASEPTIC MENINGITIS,WART,OTH) WO DX2
4	11	6	59	5.63	28.4	254	1437	13.90	37.6	26.0	11.4	02	CA OF G-I SYST W EXPLR LAPAROTOMY, RESECTION INTESTINE,OTH MAJOR OPER
5	59	0	55	4.76	33.2	0	475	3.90	41.5	8.6	2.9	11	BEN NEOPL OF UTERUS(FIBROMA),OVARY W HYSTERECTOMY(ABDOMINAL VAGINAL)
6	62	1	53	4.68	37.8	15	68	.68	42.2	1.5	1.7	12	BEN NEOPL OF SKIN, BONE, URINARY SYST, CONN TISS W OPER WO DX2
7	47	0	50	4.33	42.2	0	48	.39	42.6	1.0	3.3	10	HODGKINS DIS,RETICULM-CELL,SARCOMA WO OPER W AGE>15 WO DX2
8	54	0	45	3.90	46.1	0	97	.80	43.4	2.2	2.5	11	BEN NEOPL OF UTERUS(PAPILLOMA, POLYP),VAGINA,VULVA W DX2
9	34	3	33	3.12	49.2	142	514	5.39	48.8	18.2	7.6	07	CA OF MALE GENITAL ORG W PROSTECTOMY,OTH MAJOR OPER
10	74	0	34	2.94	52.1	0	305	2.51	51.3	9.0	3.9	14	DIABETES W AGE>35 WO OPER WO DX2 OR W MINOR DX2
11	24	1	29	2.60	54.7	51	352	3.31	54.6	13.4	7.2	05	CA OF BREAST W OPER W DX2
12	75	0	30	2.60	57.3	0	313	2.57	57.1	10.4	4.0	14	DIABETES WO OPER W MAJOR DX2
13	41	12	14	2.25	59.6	320	166	3.99	61.1	18.7	10.3	09	CA OF BRAIN, SECONDARY CA,MULTIPLE CA WO OPER W DX2
14	37	2	23	2.16	61.7	59	249	2.53	63.7	12.3	8.6	08	CA OF URINARY SYSTEM W CYSTOSCOPY, LOCAL EXCISION,OTH MINOR OPER W DX2
15	71	0	25	2.16	63.9	0	137	1.13	64.8	5.5	2.7	13	ENDOCRINE DISORDER W THYROIDECTMY, OTH MINOR OPER
16	31	11	12	1.99	65.9	205	110	2.59	67.4	13.7	7.4	07	CA OF MALE GENITAL ORG WO OPER
17	36	0	23	1.99	67.9	0	126	1.04	68.4	5.5	3.5	08	CA OF URINARY SYST W CYSTOSCOPY, LOCAL EXCISN,OTH MINOR OPER WO DX2
18	8	15	7	1.90	69.8	192	62	2.09	70.5	11.5	7.2	02	CA OF G-I SYST EXCEPT ORAL CAVITY, COLON,GALLBLADDER WO OPER
19	13	12	10	1.90	71.7	112	197	2.54	73.0	14.0	13.8	03	CA OF RESP SYSTEM WO OPER W DX2
20	57	0	19	1.65	73.3	0	41	.34	73.4	2.2	2.1	11	BEN NEOPL OF UTERUS(FIBROMA),OVARY W D&C,EXCISION UTERUS W OPER2
21	58	1	17	1.56	74.9	62	139	1.65	75.0	11.2	2.5	11	BEN NEOPL OF UTERUS(FIBROMA),OVARY W OOPHORECTOMY,HYSTEROMYOMECTOMY
22	38	2	16	1.56	76.5	60	221	2.31	77.3	15.6	7.2	08	CA OF URINARY SYSTEM W NEPHRECTMY, CYSTECTOMY,OTH MAJOR OPER
23	44	5	12	1.47	77.9	102	189	2.39	79.7	17.1	7.2	09	CA OF BONE,CONN TISSUE,NERVES, SECONDRY CA,MULTIPL CA W MAJOR OPER
24	56	0	15	1.30	79.2	0	15	.12	79.9	1.0	2.0	11	BEN NEOPL OF UTERUS(FIBROMA),OVARY W D&C,EXCISION UTERUS WO OPER2
25	76	0	15	1.30	80.5	0	884	7.27	87.1	58.9	.0	**	OUTLIERS
26	15	1	13	1.21	81.7	14	165	1.47	88.6	12.8	12.8	03	CA OF RESP SYST W BIOPSY,ENDOSCPY, OTH MINOR OPER W DX2
27	7	6	8	1.21	82.9	145	99	2.01	90.6	17.4	9.4	02	CA OF ORAL CAVITY, COLON, GALLBLADDER WO OPER
28	35	3	11	1.21	84.2	138	141	2.29	92.9	19.9	13.1	08	CA OF URINARY SYSTEM WO OPER
29	16	2	11	1.13	85.3	46	251	2.44	95.3	22.8	5.9	03	CA OF RESP SYST W LOBECTOMY, PNEUMONECTOMY,OTH MAJOR OPER
30	5	1	12	1.13	86.4	1	135	1.12	96.5	10.5	10.8	01	SEPTICEMIA, T.B., SARCOIDOSIS, SALMONELLA INFECTION WO OPER
31	49	3	10	1.13	87.5	50	133	1.59	98.0	14.1	15.3	10	MULTIPLE MYELOMA,LEUKEMIA(LYMPH, MYELOID,MONO) WO OPER W AGE>15
32	10	1	11	1.04	88.6	20	222	1.99	100.0	20.2	16.5	02	CA OF G-I SYST W BIOPSY,ENDOSCOPY, LOCAL EXCSN,OTH MINOR OPER W DX2
33	65	0	12	1.04	89.6	0	37	.30	100.3	3.1	3.9	12	BEN NEOPL OF INTESTINE, CERVIS W EXCISN OPER,OTH MINOR OPER WO DX2

Figure 8 Comulative Percent of Discharges by DRG

DIAGNOSIS RELATED GROUP	an abbreviated English description of the DRG

3.0.5 Cumulative Percent of Bed Days by DRG

This report presents frequency counts and bed day statistics identical to the previous report titled Cumulative Percent of Discharges by DRG. The rows of this report correspond to the DRGs, ordered in decreasing sequence by the total number of bed days accounted for patients in the DRG. Sample printout appears in Figure 9.

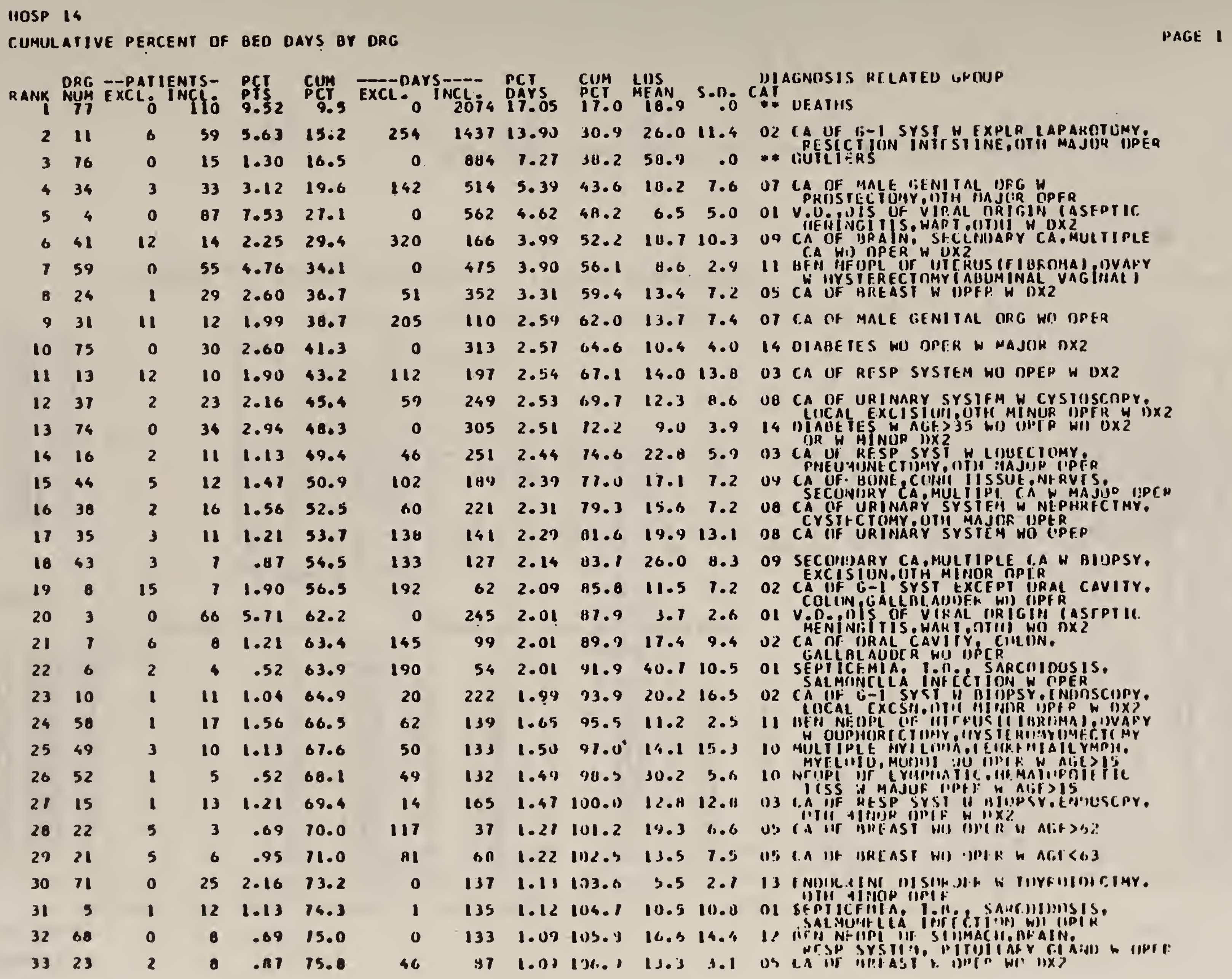
4.0 Hospital Percentiles by DRG (RANK Report)

This report provides hospital comparison statistics for each DRG and can be generated for all or a subset of the DRGs. The report contains a line of information for each PSRO hospital (or each subset of PSRO hospitals) and a line of information for all cases in the PSRO itself. It is divided into two sections, the first containing summary statistics and corresponding ranks for hospitals and the second containing a grid with a graphical profile of hospital performance with respect to length of stay. Sample printout appears in Figure 10.

For each DRG, the first section of RANK presents by hospital the number and percent of patients in the DRG, the number and percent of bed days associated with this DRG, and the number of patient deaths within the DRG. Summary columns presenting a hospital's rank across each of these variables are also presented. A description of these statistics follows:

Patients:

NUM	the number of live non-outlier discharges in this DRG for this hospital



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CUMULATIVE PERCENT OF BED DAYS BY DRG                                                                 PAGE 1

     DRG --PATIENTS-  PCT   CUM   ----DAYS----  PCT    CUM   LOS          DIAGNOSIS RELATED GROUP
RANK NUM EXCL. INCL.  PTS   PCT   EXCL.  INCL.  DAYS   PCT   MEAN   S.D. CAT
   1  77     0   110  9.52   9.5      0   2074 17.05  17.0  18.9     .0  ** DEATHS

   2  11     6    59  5.63  15.2    254   1437 13.90  30.9  26.0   11.4  02 CA OF G-I SYST W EXPLR LAPAROTOMY,
                                                                             RESECTION INTESTINE,OTH MAJOR OPER
   3  76     0    15  1.30  16.5      0    884  7.27  38.2  58.9     .0  ** OUTLIERS

   4  34     3    33  3.12  19.6    142    514  5.39  43.6  18.2    7.6  07 CA OF MALE GENITAL ORG W
                                                                             PROSTECTOMY,OTH MAJOR OPER
   5   4     0    87  7.53  27.1      0    562  4.62  48.2   6.5    5.0  01 V.D.,DIS OF VIRAL ORIGIN (ASEPTIC
                                                                             MENINGITIS,WART,OTH) W DX2
   6  41    12    14  2.25  29.4    320    166  3.99  52.2  18.7   10.3  09 CA OF BRAIN, SECONDARY CA,MULTIPLE
                                                                             CA WO OPER W DX2
   7  59     0    55  4.76  34.1      0    475  3.90  56.1   8.6    2.9  11 BEN NEOPL OF UTERUS(FIBROMA),OVARY
                                                                             W HYSTERECTOMY(ABDOMINAL VAGINAL)
   8  24     1    29  2.60  36.7     51    352  3.31  59.4  13.4    7.2  05 CA OF BREAST W OPER W DX2

   9  31    11    12  1.99  38.7    205    110  2.59  62.0  13.7    7.4  07 CA OF MALE GENITAL ORG WO OPER

  10  75     0    30  2.60  41.3      0    313  2.57  64.6  10.4    4.0  14 DIABETES WO OPER W MAJOR DX2

  11  13    12    10  1.90  43.2    112    197  2.54  67.1  14.0   13.8  03 CA OF RESP SYSTEM WO OPER W DX2

  12  37     2    23  2.16  45.4     59    249  2.53  69.7  12.3    8.6  08 CA OF URINARY SYSTEM W CYSTOSCOPY,
                                                                             LOCAL EXCISION,OTH MINOR OPER W DX2
  13  74     0    34  2.94  48.3      0    305  2.51  72.2   9.0    3.9  14 DIABETES W AGE>35 WO OPER WO DX2
                                                                             OR W MINOR DX2
  14  16     2    11  1.13  49.4     46    251  2.44  74.6  22.8    5.9  03 CA OF RESP SYST W LOBECTOMY,
                                                                             PNEUMONECTOMY,OTH MAJOR OPER
  15  44     5    12  1.47  50.9    102    189  2.39  77.0  17.1    7.2  09 CA OF BONE,CONN TISSUE,NERVES,
                                                                             SECONDRY CA,MULTIPL CA W MAJOR OPER
  16  38     2    16  1.56  52.5     60    221  2.31  79.3  15.6    7.2  08 CA OF URINARY SYSTEM W NEPHRECTMY,
                                                                             CYSTECTOMY,OTH MAJOR OPER
  17  35     3    11  1.21  53.7    138    141  2.29  81.6  19.9   13.1  08 CA OF URINARY SYSTEM WO OPER

  18  43     3     7   .87  54.5    133    127  2.14  83.7  26.0    8.3  09 SECONDARY CA,MULTIPLE CA W BIOPSY,
                                                                             EXCISION,OTH MINOR OPER
  19   8    15     7  1.90  56.5    192     62  2.09  85.8  11.5    7.2  02 CA OF G-I SYST EXCEPT ORAL CAVITY,
                                                                             COLON,GALLBLADDER WO OPER
  20   3     0    66  5.71  62.2      0    245  2.01  87.9   3.7    2.6  01 V.D.,DIS OF VIRAL ORIGIN (ASEPTIC
                                                                             MENINGITIS,WART,OTH) WO DX2
  21   7     6     8  1.21  63.4    145     99  2.01  89.9  17.4    9.4  02 CA OF ORAL CAVITY, COLON,
                                                                             GALLBLADDER WO OPER
  22   6     2     4   .52  63.9    190     54  2.01  91.9  40.7   10.5  01 SEPTICEMIA, T.B., SARCOIDOSIS,
                                                                             SALMONELLA INFECTION W OPER
  23  10     1    11  1.04  64.9     20    222  1.99  93.9  20.2   16.5  02 CA OF G-I SYST W BIOPSY,ENDOSCOPY,
                                                                             LOCAL EXCSN,OTH MINOR OPER W DX2
  24  58     1    17  1.56  66.5     62    139  1.65  95.5  11.2    2.5  11 BEN NEOPL OF UTERUS(FIBROMA),OVARY
                                                                             W OOPHORECTOMY,HYSTEROMYOMECTOMY
  25  49     3    10  1.13  67.6     50    133  1.50  97.0  14.1   15.3  10 MULTIPLE MYELOMA,LEUKEMIA(LYMPH,
                                                                             MYELOID,MONO) WO OPER W AGE>15
  26  52     1     5   .52  68.1     49    132  1.49  98.5  30.2    5.6  10 NEOPL OF LYMPHATIC,HEMATOPOIETIC
                                                                             TISS W MAJOR OPER W AGE>15
  27  15     1    13  1.21  69.4     14    165  1.47 100.0  12.8   12.8  03 CA OF RESP SYST W BIOPSY,ENDOSCPY,
                                                                             OTH MINOR OPER W DX2
  28  22     5     3   .69  70.0    117     37  1.27 101.2  19.3    6.6  05 CA OF BREAST WO OPER W AGE>62

  29  21     5     6   .95  71.0     81     60  1.22 102.5  13.5    7.5  05 CA OF BREAST WO OPER W AGE<63

  30  71     0    25  2.16  73.2      0    137  1.11 103.6   5.5    2.7  13 ENDOCRINE DISORDER W THYROIDECTMY,
                                                                             OTH MINOR OPER
  31   5     1    12  1.13  74.3      1    135  1.12 104.7  10.5   10.8  01 SEPTICEMIA, T.B., SARCOIDOSIS,
                                                                             SALMONELLA INFECTION WO OPER
  32  68     0     8   .69  75.0      0    133  1.09 105.9  16.6   14.4  12 BEN NEOPL OF STOMACH,BRAIN,
                                                                             RESP SYSTEM, PITUITARY GLAND W OPER
  33  23     2     8   .87  75.8     46     97  1.03 106.9  13.3    3.1  05 CA OF BREAST W OPER WO DX2
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Figure 9 Cumulative Percent of Bed Days by DRG

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REPORT 4
RANK REPORT                                                                                              PAGE 1
        CATEGORY 02    DRG 8     CA OF G-I SYST EXCEPT ORAL CAVITY, COLON,GALLBLADDER WO OPER
                        <-----------PATIENTS-----------><------------BED DAYS-------------><------DEATHS-----><------HOSPITAL RANKS------>
REF                          -----HOSP---------DRG------        -----HOSP---------DRG------          PER                PATIENTS   BED DAYS
NUM                       NUM    PCT  RANK     PCT  RANK    DAYS    PCT  RANK     PCT  RANK    NUM  1000  RANK   RANK HOSP  DRG  HOSP  DRG
 11 HOSP 11                13   6.07     3    5.39     5      99   7.61     4    4.37     7      2     *    --      1   12   12    16   16
 12 HOSP 12                74  13.55     1   30.70     1     448   9.96     2   19.78     2     26   260     6      2   16   16    12   12
 13 HOSP 13                 3   2.08    11    1.24    12      24   2.30    12    1.06    12      1     *    --      3   11   15    19   15
 14 HOSP 14                 7   3.00     9    2.90     8      62   3.06    10    2.74    10     15   682     1      4   25   19    11   19
 15 HOSP 15                33   4.53     6   13.69     3     305   5.97     5   13.46     3     13   283     5      5   19   11    15   20
 16 HOSP 16                50  10.22     2   20.75     2     598  11.31     1   26.40     1     14   219     7      6   15   21    25   21
 17 HOSP 17                 6   3.61     8    2.49    10      73   4.33     8    3.22     9      4     *    --      7   23   20    23   11
 19 HOSP 19                17   4.64     5    7.05     4     223   8.79     3    9.84     4     14   452     3      8   17   14    17   22
 20 HOSP 20                12   1.89    12    4.98     7     163   2.94    11    7.20     5     19   613     2      9   14   22    22   17
 21 HOSP 21                12   1.71    13    4.98     6     142   2.24    13    6.27     6      9   429     4     10   22   17    14   14
 22 HOSP 22                 7   2.12    10    2.90     9      74   3.66     9    3.27     8      7     *    --     11   13   23    20   23
 23 HOSP 23                 4   4.30     7    1.66    11      32   4.35     7    1.41    11      3     *    --     12   20   13    13   13
 24 HOSP 24                 1    .34    14     .41    14      14    .79    14     .62    13      3     *    --     13   21   25    21   24
 25 HOSP 25                 2   5.00     4     .83    13       8   5.80     6     .35    14      1     *    --     14   24   24    24   25
    *** TOTALS ***        241                               2265                               131

      -- RANK NOT CALCULATED      * DEATHS PER 1000 NOT CALCULATED

REPORT 7

                         LOS PROFILE IN DAYS
                     0         10        20        30        40        50        60        70
                    |+---------+---------+---------+---------+---------+---------+---------+----|   OBS     MEAN     S.D. MEDIAN
    HOSP 25         |    M                                                                      |     2     4.00      .00      4
    HOSP 23         |    M--X---------*                                                         |     4     8.00     5.34      4
    HOSP 11         |    XM-----X---*                                                           |    13     7.62     4.25      5
    HOSP 22         |   X-M----X------------------------------*                                 |     7    10.57    12.66      5
    HOSP 12         |*X---M--X-----*                                                            |    74     6.05     6.42      5
    HOSP 17         |   *X-M---X-----------------------------*                                  |     6    12.17    12.73      6
  *** TOTAL ***     | *--X--M-----X--------*                                                    |   241     9.40     8.50      7
    HOSP 19         |    *--XM------X----------------*                                          |    17    13.12    10.31      8
    HOSP 15         |    *X--M--X----*                                                          |    33     9.24     6.71      9
    HOSP 21         |  *--X--M---X----------*                                                   |    12    11.83    10.17      8
    HOSP 13         |  X-----M-----X                                                            |     3     8.00     4.90      8
    HOSP 16         |  *--X----M-------X----*                                                   |    50    11.96     8.78     10
    HOSP 20         | *---X-------M-----X----*                                                  |    12    13.58    10.17     13
    HOSP 14         |X------------M--X*                                                         |     7     8.06     7.22     13
    HOSP 24         |              M                                                            |     1    14.00      .00     14
                    |+---------+---------+---------+---------+---------+---------+---------+----|
                     0         10        20        30        40        50        60        70

          M=MEDIAN     * BEFORE MEDIAN=10%ILE     X BEFORE MEDIAN=25%ILE     X AFTER MEDIAN=75%ILE     * AFTER MEDIAN=90%ILE
          + SUB-TOTAL OMITTED FROM TOTALS
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Figure 10 Hospital Percentiles by DRG (RANK Report)

HOSP PCT	the percent of all live non-outlier discharges for the hospital in the DRG (i.e. the denominator is the total number of discharges in the hospital and the numerator is NUM)
HOSP RANK	the hospital's rank with respect to HOSP PCT (i.e. the hospital with the highest HOSP PCT has rank 1)
DRG PCT	the percent of total live non-outlier discharges in the DRG accounted for by this hospital (i.e. the denominator is the total number of live non-outlier discharges in the DRG and the numerator is NUM)
DRG RANK	the hospital's rank with respect to DRG PCT (i.e. the hospital with the highest DRG PCT has rank 1)

Bed Days:

DAYS	the number of bed days
HOSP PCT	the percent of all bed days for the hospital accounted for by the DRG (i.e. the denominator is the total number of bed days in the hospital and the numerator is DAYS)
HOSP RANK	the hospital's rank with respect to HOSP PCT (i.e. the hospital with the highest HOSP PCT has rank 1)
DRG PCT	the percent of the total number of bed days in the DRG accounted for by this hospital (i.e. the denominator is the total number of bed days in the DRG and the numerator is DAYS)
DRG RANK	the hospital's rank with respect to DRG PCT (i.e. the hospital with the highest DRG PCT has rank 1)

Deaths:

NUM	the number of deaths
PER 1000	the death rate per 1000 population (this is only calculated for hospitals with more than 20 observations - live non-outliers and deaths)
RANK	the hospital's rank with respect to DEATHS PER 1000

Hospital Ranks:

RANK	the sequential ranks from 1 to the number of hospitals
PATIENTS HOSP	the hospital for which the DRG accounts for the largest percentage (HOSP PCT) of its total discharges will be ranked first
PATIENTS DRG	the hospital with the largest percent of total patients in the DRG (DRG PCT) will be ranked first
BED DAYS HOSP	the hospital for which the DRG accounts for the largest percentage (Bed Days HOSP PCT) of its total bed days will be ranked first
BED DAYS DRG	the hospital with the largest percent of bed days in the DRG (bed days DRG PCT) will be ranked first

The second section of the RANK report presents an institutional length of stay profile with the hospital number followed by a grid containing the median (M), the inter-quartile range (25th (first X) to 75th (second X) percentile), the 10th (first *) percentile, and 90th (second *) percentile of length of stay for each hospital. To the right of the grid are columns containing the number of live non-outlier discharges (OBS), the mean or average length of stay (MEAN), the standard deviation for length of stay (S.D.), and the median (MEDIAN) length of stay or 50th percentile.

List of Trim Points

DRG	TRIM POINT	ENGLISH DESCRIPTION
1	20	enteritis,diarrheal dis of age<16
2	37	enteritis,diarrheal dis of age>15
3	26	venereal dis, viral origin dis(aseptic meningitis,wart,oth) wo dx2
4	27	venereal dis,viral origin dis(aseptic meningitis,wart,oth) w dx2
5	50	septicemia,tbc,sarcoidosis,salmonella infectn wo oper
6	58	septicemia,tbc,sarcoidosis,salmonella infectn w oper
7	44	ca of oral cavty,colon,gallbldr wo oper
8	51	ca of g-i syst except oral cavty,colon,gallbldr wo oper
9	42	ca of g-i syst w bipsy,endoscpy,local excsn,oth minor oper wo dx2
10	62	ca of g-i syst w bipsy endoscpy,local excsn,oth minor oper w dx2
11	63	ca of g-i syst w explr lapltmy,resectn intestin,oth major oper
12	57	ca of resp syst wo oper wo dx2
13	52	ca of resp syst wo oper w dx2
14	38	ca of resp syst w bipsy, endoscpy,oth minor oper wo dx2
15	54	ca of resp syst w bipsy, endoscpy,oth minor oper w dx2
16	62	ca of resp syst w lobectmy,pneumonectmy,oth major oper
17	32	ca of skin except malig melanoma wo dx2
18	38	ca of skin except malig melanoma w dx2
19	28	malig melanoma wo dx2
20	42	malig melanoma w dx2
21	43	ca of breast wo oper of age<63
22	48	ca of breast wo oper of age>62
23	20	ca of breast w oper wo dx2
24	44	ca of breast w oper w dx2
25	22	ca of female genitl org wo oper wo dx2
26	42	ca of female genitl org wo oper w dx2
27	25	ca of female genitl org w bipsy,local excisn,oth minor oper wo dx2
28	35	ca of female genitl org w bipsy,local excisn,oth minor oper w dx2
29	29	ca of uterus-corpus w histrectmy,explr laparotomy,oth major oper
30	56	ca of uterus-cervix, ovary w histrectmy,oth major oper
31	44	ca of male genitl org wo oper
32	37	ca of male genitl org w bipsy,cystoscpy,orchiectmy wo dx2
33	46	ca of male genitl org w bipsy,cystoscpy,orchiectmy w dx2
34	42	ca of male genitl org w prostectmy,oth major oper
35	43	ca of urinary syst wo oper

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36          22          ca of urinary syst w cystoscpy, local excisn,oth minor oper wo dx2
37          34          ca of urinary syst w cystoscpy,local excisn,oth minor oper w dx2
38          56          ca of urinary syst w nephrectmy,cystectmy,oth major oper
39          32          ca of bone, thyroid,conn tissue,nerves wo oper
40          39          ca of brain, secondary ca, multipl ca wo oper wo dx2
41          51          ca of brain,secondary ca,multipl ca wo oper w dx2
42          37          ca of thyroid,conn tissue,nerves w bipsy,excisn,oth minor oper
43          55          secondary ca,multipl ca w bipsy,excisn,oth minor oper
44          75          ca of bone,conn tissue,nerves,secondary ca,multipl ca w major oper
45          22          neopl of lymphatic,hemopoietic tissue of age<16 wo dx2
46          33          neopl of lymphatic,hemopoietic tissue of age<16 w dx2
47          26          hodgkins dis,reticulm-cell sarcma wo oper of age>15 wo dx2
48          37          hodgkins dis,reticulm-cell sarcma wo oper of age>15 w dx2
49          55          multipl myeloma,leukemia(lymph,myeloid,mono)wo oper of age >15
50          39          neopl of lymptic,hematopoietic tiss w minor oper of age>15 wo dx2
51          61          neopl of lymptic,hematopoietic tiss w minor oper  of age>15 w dx2
52          46          neopl of lymptic,hematopoietic tiss w major oper of age>15
53          10          ben neopl of uterus(papiloma,polyp),vagina,vulva wo dx2
54          20          ben neopl of uterus(papiloma,polyp),vagina,vulva w dx2
55          20          ben neopl of uterus(fibroma),ovary wo oper
56          18          ben neopl of uterus(fibroma),ovary w d&c,excisn uterus wo oper2
57          23          ben neopl of uterus(fibroma),ovary w d&c,excisn uterus w oper2
58          20          ben neopl of uterus(fibroma),ovary w oophorectmy,hysteromyomectmy
59          22          ben neopl of uterus(fibroma),ovary w hystrectmy(abdominal,vaginal)
60          28          ben neopl of intestin,urinary syst,lipoma,hemangioma wo oper
61          36          ben neopl of brain,pituitary gl,oth unspec wo oper
62          13          ben neopl of skin,bone,urinary syst,conn tiss w oper wo dx2
63          12          ben neopl of skin,bone,urinry sys,conn tiss w oper w dx2 of age<43
64          24          ben neopl of skin,bone,urinry sys,conn tiss w oper w dx2 of age>42
65          24          ben neopl of intestin, nerves w excisn orgs,oth minor oper wo dx2
66          35          ben neopl of intestin,nerves w excisn orgs,oth minor oper w dx2
67          43          ben neopl of intestin,nerves w explr laplatmy,oth major oper
68          63          ben neopl of stomach,brain,resp syst,pituitary gl w oper
69          24          goiter(simpl,nontoxic),endoc dis(adrnt,oth minor) wo oper
70          33          thyrotoxicosis,myxedema,pituitary hypofunctn wo oper
71          20          endocrine disdrder w  minor oper
72          50          endocrine disorder w hypophysectmy,parathyroidectmy oth maj oper
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73	21	diabetes of age<36 wo oper wo dx2 or w minor dx2
74	27	diabetes of age>35 wo oper wo dx2 or w minor dx2
75	35	diabetes wo oper w major dx2
76	51	diabetes w endoscpy,bipsy,photocoagulation retina,oth minor oper
77	86	diabetes w amputatn extremity,oth major oper
78	22	metabolic dis of gout,globulinopathy,xanthomatosis wo dx2
79	30	metabolic dis of gout,globulinopathy,xanthomatosis w dx2
80	34	metabolic dis of cystic fibrosis,sprue,steatorrhea,oth & unspec
81	51	metabolic dis,of unspec obesity,amyloidosis hepatolenticular degn
82	14	mediter anemia,hemophilia of age<11 wo oper wo dx2 or minor dx2
83	26	mediter anemia hemophilia of age>10 wo oper wo dx2 or w minor dx2
84	32	hemoglobinopathy,thrombocytopenia wo oper wo dx2 or w minor dx2
85	42	dis of blood & blood forming org wo oper w major dx2
86	40	dis of blood & blood forming org w oper of age 2-53
87	51	dis of blood & blood forming org w oper of age<1 or age>53
88	90	schizo(paranoid,catatonic,unspec),invol melancholia w psych serv
89	50	schizo(paranoid,catatonic,unspec),invol melancholia wo psych serv
90	90	schizo(affective,acute episode),manic-depressive psychosis
91	36	neuroses(anxiety,hysterical,phobic,hypochondriacal,unspec)
92	62	neuroses(obsessive-compulsive,depressive),personality disorders
93	35	alcoholism wo dx2 or w minor dx2
94	47	alcoholism w liver cirrhosis,delirium tremens or oth major dx2
95	40	drug dependence, dis presum psychogenic origin,cephalagia
96	75	psychosis, nonpsychosis related brain condition
97	23	epilepsy migraine,brain dis(unspec) wo oper wo dx2
98	35	epilepsy,migraine,brain dis(unspec) wo oper w dx2
99	60	multipl sclerosis,paralysis agitans,meningitis,hemiplegia wo oper
100	69	dis of central nervous syst w minor oper
101	81	dis of central nervous syst w major oper
102	29	facial paralysis, neuralgia(trigeminal,oth,unspec) wo oper
103	38	sciatica,polyneuritis wo oper
104	14	dis of median nerve w oper
105	18	dis of peripheral nerves except median w minor oper
106	50	dis of peripheral nerves except median w major oper
107	16	strabismus,cataract,chalazion wo oper
108	21	glaucoma,keratitis(ulceratn),dis(uvea,optic nerve,retina) wo oper
109	8	dis of eye w mymectmy,blepharorrhaphy,oth minor oper

110	13	dis of eye w extractn lens,sclerotomy,sclerectmy
111	26	dis of eye w reattachment of retina,keratoplasty
112	15	otitis media,chronic mastoiditis,otosclerosis wo oper
113	20	labyrinthitis,menieres dis wo oper
114	5	dis of ear w myringotomy,adenoidectmy or oth minor oper
115	8	dis of ear w stapectmy,tympanoplasty
116	18	dis of ear w mastoidectmy, excisn middle ear, oth major oper
117	22	hypertensive heart dis wo oper wo dx2 or minor dx2
118	26	essential ben hypertension wo oper w major dx2
119	38	malig hypertensn,hypertensive dis(ht,renal)wo oper w major dx2
120	43	hypertensive heart dis w oper
121	45	acute myocardial infarction
122	24	ischemic heart dis except a-m-i wo oper wo dx2
123	29	ischemic heart dis except a-m-i wo oper w minor dx2
124	34	ischemic heart dis except a-m-i wo oper w major dx2
125	22	ischemic heart dis except a-m-i w cardiac catheterization
126	49	ischemic heart dis except a-m-i w endscpy,insertn of electr device
127	53	ischemic heart dis except a-m-i w shunt oper,oth major oper
128	27	arrythmia & slowed conductn wo oper wo dx2 or w minor dx2
129	32	arrythmia & slowed conductn wo oper w major dx2
130	31	arrythmia & slowed conductn w replace ht device, ht cathetrizatn
131	43	arrythmia & slowed conductn w insertn of electric ht device
132	37	heart failure wo oper
133	63	heart failure w oper
134	33	carditis,valvular heart dis wo oper wo dx2 or w minor dx2
135	41	carditis,valvular heart dis wo oper w major dx2
136	24	carditis,valvular heart dis w ht cathetrizatn wo dx2 or minor dx2
137	32	carditis,valvular heart dis w ht catheterizatn w major dx2
138	68	carditis,valvular heart dis w ht valve oper,oth major oper
139	26	transient cerebral ischemia wo oper wo dx2 or w minor dx2
140	33	transient cerebral ischemia wo oper w major dx2
141	33	cerebral thrombo-embolism wo oper wo dx2 or w minor dx2
142	45	cerebral thrombo-embolism wo oper w major dx2
143	50	hemorrhage(cerebral,subarachnoid) wo oper wo dx2 or w minor dx2
144	69	hemorrhage(cerebral,subarachnoid) wo oper w major dx2
145	79	cerebrovascular diseases w oper
146	25	lymphadenitis,unspec varicose(lower ext),raynauds synd wo oper

147	40	arteriosclerosis,thrombo-embo(artery) wo oper dx2 or w minor dx2
148	45	arteriosclerosis,thrombo-embo(artery) wo oper w major dx2
149	13	dis of vascular syst w excisn varicose,oth minor oper of age<51
150	38	dis of vascular syst w excisn varicose,oth minor oper of age>50
151	50	dis of vascular syst w sympathectmy,excisn vessel wo dx2
152	76	dis of vascular syst w sympathectmy,excisn vessel w dx2
153	78	dis of vascular syst w reconstructn artery,amputatn extremity
154	36	pulmonary embolism wo dx2 or minor dx2
155	44	pulmonary embolism w major dx2
156	30	phlebitis & thrombophlebitis wo dx2 or w minor dx2
157	37	phlebitis & thrombophlebitis w major dx2
158	18	hemorrhoids
159	5	hypertrophy of tonsil & adenoid
160	14	acute u-r-i & influenza of age<45
161	25	acute u-r-i & influenza of age >44
162	16	dis of upper resp tract except acute u-r-i & influenze wo oper
163	8	dis of upper resp tract w bipsy,endoscpy,sectn nasal septum
164	11	dis of upper resp tract w rhinoplasty,sinusotomy,plastic oper nose
165	19	pneumonia of age<31
166	25	pneumonia of age>30 wo dx2 wo oper
167	37	pneumonia of age>30 w dx2 wo oper
168	64	pneumonia w oper
169	16	bronchitis of age<46
170	24	bronchtis of age>45 wo dx2 or w minor dx2
171	33	bronchitis of age>45 w major dx2
172	15	asthma of age<31
173	22	asthma of age>30 wo dx2
174	30	asthma of age>30 w dx2
175	31	pneumothorax,pleurisy,pul congestn wo oper
176	32	emphysema,empyema,abscess, edema wo oper wo dx2 or w minor dx2
177	38	emphysema,empyema,abscess,acute edema wo oper w major dx2
178	32	dis of lung & pleura w bronchoscpy,thoractmy,oth minor oper wo dx2
179	54	dis of lung & pleura w bronchoscpy,thoracotmy,oth minor oper w dx2
180	74	dis of lung & pleura w lobectomy,oth major oper
181	6	minor problems of teeth
182	15	major problems of teeth,dis(jaw,salivary gld,oth oral soft tissue)
183	21	gastric & peptic ulcer wo oper wo dx2

184	30	gastric & peptic ulcer wo oper w dx2
185	38	gastric & peptic ulcer w bipsy,endoscpy,entrorrhaphy,oth minor op
186	38	gastric & peptic ulcer w gastric resectn,oth major oper wo dx2
187	59	gastric & peptic ulcer w gastric resectn,oth major oper w dx2
188	16	upper g-i dis except peptic ulcer wo oper wo dx2
189	21	upper g-i dis except peptic ulcer wo oper w dx2
190	25	upper g-i dis except peptic ulcer w endscpy,oth minor oper wo dx2
191	35	upper g-i dis except peptic ulcer w endscpy,oth minor oper w dx2
192	52	upper g-i dis except peptic ulcer w major oper
193	12	appendicitis(without peritonitis) wo dx2
194	27	appendicitis(without peritonitis) w dx2
195	25	appendicitis(with peritonitis,unqualified,oth) wo dx2
196	50	appendicitis(with peritonitis,unqualified,oth) w dx2
197	8	abd hernia of age<15
198	11	inguinal hernia(wo obstructn) of 14<age<65 wo dx2
199	17	inguinal hernia (wo obstructn) of 14<age<65 w dx2
200	19	abd hernia except simple inguinal of 14<age<65 wo oper
201	21	abd hernia except simple inguinal of 14<age<65 w minor repair oper
202	30	abd hernia except simple inguinal of 14<age<65 w major repair oper
203	23	abd hernia of age>64 wo oper
204	20	abd hernia of age>64 w minor repair oper
205	32	abd hernia of age>64 w major repair oper
206	21	functnal disorder of intestine wo oper
207	25	intestinl diverticula,regionl enteritis,ulcerative colitis wo oper
208	27	intestin(diverticula,functnl disorder) w minor oper wo dx2
209	33	intestin(diverticula,functnl disorder) w minor oper w dx2
210	54	intestin(diverticula,functnl disorder) w resectn,oth major oper
211	12	dis of anus wo dx2
212	21	dis of anus w dx2
213	23	misc dis of intestin & peritoneum of age<56 wo oper
214	28	misc dis of intestin & peritoneum of age>55 wo oper wo dx2
215	34	misc dis of intestin & peritoneum of age>55 wo oper w dx2
216	21	misc dis of intestin & peritoneum w local incisn,excisn
217	37	misc dis of intestin & peritoneum w endoscopy of intestine wo dx2
218	41	misc dis of intesn & peritoneum w endoscopy of intestine w dx2
219	39	misc dis of intestin & peritoneum w major oper wo dx2
220	61	misc dis of intestin & peritoneum w major oper w dx2

221	36	hepatitis(infectious,serum),subacute necrosis of liver of age<41
222	48	hepatitis(infectious,serum),subacute necrosis of liver of age>40
223	48	liver cirrhosis wo dx2 or w minor dx2
224	61	liver cirrhosis w major dx2
225	18	dis of gall bladder & bile duct wo oper of age<51
226	28	dis of gall bladder & bile duct wo oper of age>50
227	24	dis of gall bladder & bile duct w oper wo.dx2
228	31	dis of gall bladder & bile duct w oper w dx2 of age<65
229	45	dis of gall bladder & bile duct w oper w dx2 of age>64
230	29	dis of pancreas wo oper
231	69	dis of pancreas w oper
232	20	dis of kidney & bladder wo oper wo dx2
233	28	nephritis(unqualified),pyelonephritis(oth) wo oper w dx2
234	37	nephr synd, nephritis(chr),uremia wo oper w dx2 of age<65
235	49	nephrotic synd,nephritis(chr),uremia wo oper w dx2 of age>64
236	26	dis of ureter,nephrotic synd w cystscpy,bipsy,oth minor oper
237	48	nephritis,nephrosis,pyelitis w cystscpy,bipsy,oth minor oper
238	61	dis of kidney & ureter w nephrectmy,kid transplant,oth major oper
239	11	urinary calculus wo oper wo dx2
240	18	urinary calculus wo oper w dx2
241	24	urinary calculus w cystscpy,catheter to kidney,oth minor oper
242	35	urinary calculus w nephrotmy,cystotmy,ureterotmy,oth major oper
243	20	cystitis & oth urinary dis wo oper wo dx2
244	26	cystitis,urethritis,stricture urethra wo oper w dx2
245	23	bladder(fistula,diverticula,oth dis) wo oper w dx2 of age<46
246	34	bladder(fistula diverticula,oth dis) wo oper w dx2 of age>45
247	9	dis of bladder & urethra w meatotomy
248	12	dis of bladder & urethra w cystscpy,excisn,dil,repair of age<15
249	26	dis of bladder & urethra w cystscpy,excisn,dil,repair of age>14
250	45	dis of bladder & urethra w cystectmy,prostectmy,oth major oper
251	29	dis of prostate wo oper
252	21	dis of prostate w cystoscpy,dil urethra,bipsy wo dx2
253	30	dis of prostate w cystoscpy,dil urethra,bipsy w dx2
254	25	dis of prostate w transurethral prostectomy wo dx2
255	38	dis of prostate w transurethral prostectomy w dx2
256	36	dis of prostate w suprapubic prostectomy
257	7	redundant prepuce & phimosis

258	20	dis of male genital organ except phimosis wo oper
259	13	dis of male genital organ except phimosis w oper of age<45
260	22	dis of male genital organ except phimosis w oper of age>44
261	13	disorder of menstruation wo oper
262	14	dis of female gen org except disorder of menstruation wo dx2
263	22	dis of female gen org except disorder of menstruation w dx2
264	7	dis of female gen org w d&c,perineoscpy,salphingectmy wo dx2
265	11	dis of female gen org w d&c,perineoscpy,oth minor oper w dx2
266	21	dis of female gen org w hysterectmy,repair female gen org,maj oper
267	7	ben neopl,chr cystic dis of breast wo dx2
268	11	acute mastitis,hypertrophy of breast wo dx2
269	12	dis of breast w dx2 of age<56
270	21	dis of breast w dx2 of age>55
271	5	abortion wo dx2
272	10	abortion w dx2
273	4	false labor wo oper
274	9	threatened abortion,placenta previa,oth hemorr pregnancy wo oper
275	13	toxemia,hyperemesis gravidarum,thrombophlebitis(puerperal)wo oper
276	9	obst dis of antepartum & post partum w d&c repair int cervical os
277	20	obst dis of antepartum & post partum w sal-oophrectmy,oth maj oper
278	7	delivery wo oper or w oper assisting delivery
279	10	delivery w ligation of fallopian tube,salpingectomy
280	13	delivery w c-section
281	8	delivery with complication wo oper or w oper assisting delivery
282	13	delivery with complication w c-section
283	15	keloid,cicatrix,sebaceous cyst, oth minor skin dis wo dx2
284	28	keloid,cicatrix,sebaceous cyst,oth minor skin dis w dx2
285	16	cellulitis & abscess of skin,eczema,chr ulcer wo oper of age<21
286	31	cellulitis & abscess of skin,eczema,chr ulcer wo oper of age>20
287	31	cellulitis & abscess of skin,eczema,erythma conditn w oper wo dx2
288	61	cellulitis & abscess of skin,eczema,erythma conditn w oper w dx2
289	70	psoriasis,pemphigus,chr ulcer of skin
290	29	arthritis wo oper of age<65
291	41	arthritis wo oper of age>64
292	38	arthritis w excisn(bone,joint,synovium),arthrodesis
293	49	arthritis w arthrotomy,spinal fusn,excisn intervert cartilage
294	53	arthritis w repair & plastic oper(joint,hip),laminectomy

295	33	derangement & displacement of intervertebral disc wo oper
296	53	derangement & displacement of intervertebral disc w oper
297	28	rhematism,periostitis,oth minor bone dis wo oper
298	47	osteomyelitis(acute,chr),osteoporosis,spont fracture wo oper
299	18	dis of bone & cartilage w excisn semilunar cart,repair oth joint
300	40	dis of bone & cartilage w arthrotmy,excisn bone,fusn bone
301	67	dis of bone & cartilage w amputatn,arthroplasty hip,oth major oper
302	23	bunion synovitis bursitis,tenosynovitis,scoliosis,defrm foot wo op
303	30	lumbalgia,diff dis of conn tiss,myositis wo oper wo dx2
304	48	lumbalgia,diff dis of conn tiss,myositis wo oper w dx2
305	13	synovitis,tendonitis bursitis,deformity(finger,toe,palm) w oper
306	18	oth dis of musculoskeletal syst w minor oper
307	26	oth dis of musculoskeletl syst w excisn,repair(small joint & bone)
308	50	oth dis of musculoskeletl syst w spinal fusn,oth maj oper
309	19	osteogenesis imperfecta,pyloric stenosis,undesc testicle wo oper
310	31	congenital anomaly(heart,kidney,oth major) wo oper
311	13	cong anom(testicle skin,pyloric stenosis,oth minor) w oper
312	13	cong anom of ht(valve,unspec) w ht catheterization
313	22	cong anom(palate,lip,hip,oth extr) w repair(lip,palate),arthrdesis
314	47	cong anom of ht(valve,unspec) w oper on ht(valve,septum)
315	16	a-s-d,t-o-f,p-d-a,c-o-a,hypospadia w cathrin,repair urethra
316	55	a-s-d,t-o-f,p-d-a,c-o-a w oper on valve septum,shunt
317	55	cong anom(spine,esophageal atresia,hirschsprung dis) w oper
318	9	normal mature born
319	27	well baby care,post maturity,oth minor dis or cond of newbrn inf
320	38	immaturity,hyaline memb dis, oth maj dis or cond of infant wo dx2
321	68	immaturity,hyaline memb dis,oth major dis or cond of infant w dx2
322	18	symptom or signs(nerve,resp,circul syst) wo oper wo dx2
323	23	convulsion,syncope,epistaxis,chest pain wo oper w dx2
324	32	vertigo,encephalopathy,dyspnea,hemoptysis wo oper w dx2
325	18	symptom or signs(nerve,resp,circul syst) w minor oper
326	52	symptom or signs(nerve,resp,circul syst) w major oper
327	17	symptom or signs (g-i,urinary syst) wo oper wo dx2
328	25	symptom or signs (g-i,urinary syst) wo oper w dx2
329	31	symptom or signs(g-i,urinary syst) w endoscopy,oth minor oper
330	40	symptom or signs(g-i,urinary syst) w expl lapartmy, oth major oper
331	16	sterility(male, female), admission for observ wo oper

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332     19      electro disor,headache,pyrexia,oth ill-def symt wo oper of age<15
333     32      electro disor,headache,pyrexia,oth ill-def symt wo oper of age>14
334     18      misc sympt or signs w perineoscopy,cystoscopy oth minor oper
335     42      misc sympt or signs w hysterectomy,expl lapartmy,oth major oper,
336     19      fx(skull,face,forearm,tibia,fibula,foot,hand) wo oper of age<30
337     35      fx(skull,face,forearm,tibia,fibula,foot,hand) wo oper of age>29
338     31      fx(spine,rib,humerus) wo oper of age<65
339     41      fx(spine,rib,humerus)wo oper of age>64
340     60      fx(femur,pelvis,multiple) wo oper
341     11      fx(nasal,forearm,hand,lower leg,foot) w close reductn wo dx2
342     24      fx(nasal,forearm,hand,lower leg,foot) w close reductn w dx2
343     29      fx(mandbl,humerus,ankle)w close redctn,open redctn for face wo dx2
344     48      fx(mandbl,humerus,ankle)w close redctn,open redctn for face w dx2
345     22      fx(arm,hand,foot,clavicle) w open reductn ext fixatn,debridement
346     47      fx(ankle,tibia & fibula) w open reductn ext fixatn, debridement
347     72      fx(femur,pelvis) w open reductn,ext fixatn,debridement
348     66      fx of bone w amputatn arthroplasty of hip oth major oper
349     23      dislocatn(shouldr,elbow,wrist,knee),sprains(ankl,foot,hand)wo oper
350     27      disloctn(jaw,hip),sprains(knee,sacroiliac,oth,unspec)wo oper
351     13      dislocatn(shoulder,elbow,hand),sprains(elbow,wrist,hand) w oper
352     21      dislocatn(knee,ankle),sprains(shoulder,knee,ankle) w oper
353     43      dislocatn(hip,multiple),sprains(hip,sacroiliac,oth,unspec) w oper
354     10      internal injury of cranium,oth org wo oper wo dx2 of age<41
355     19      internal injury of cranium,oth org wo oper w dx2 of age<41
356     32      internal injury of cranium,oth org wo oper of age>40
357     20      internal injury w suture(skin,nerve),neuroplasty oth minor oper
358     51      internal injury w splenectmy,thoracotmy,pleurotmy,excisn skin
359     96      internal injury w craniotomy,expl laparotomy
360     15      open wound not complicated,superficial injury,foreign body wo oper
361     22      open wound complicated,contusn,multiple injury wo oper wo dx2
362     27      open wound complicated,contusn,multiple injury wo oper w dx2
363     12      open wound(extr),foreign body w endoscpy,suture,oth minor oper
364     23      open wound(compl,head,multiple) w endscpy,suture,oth minor oper
365     23      open wound(extr),superf injury w excisn,debridement,oth major oper
366     50      open wound(compl,body,multiple) w excisn,debridement,oth major op
367     46      burn of 1st degr,2nd degr uncompl,less than 20% of body
368     73      burn of 2nd degr compl, 3rd degr, over than 20% of body
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369	22	compl of surgical or medical care wo oper wo dx2
370	37	compl of surgical or medical care wo oper w dx2
371	21	compl of surgical or medical care w minor oper
372	24	compl of surgical or medical care w replace ht device,repair stoma
373	53	compl of surgical or medical care w revisn shunt,oth major oper
374	14	adverse effect of drug,toxic effect of alcohol wo dx2
375	23	adverse effect of drug,toxic effect of alcoholic w dx2
376	24	toxic effect(lead,acid,alkali,carbon monoxide,radiation) wo dx2
377	42	toxic effect(lead,acid,alkali,carbon monoxide,radiation) w dx2
378	4	prenatal care,medical & surgical after care(dialysis) wo oper
379	15	admission(for sterilization,chemother,radiation ther) wo oper
380	35	followup(ca),surg-med aftr care(colostomy,orthop,oth) wo oper
381	7	special admission w oper on sterilization or d&c
382	14	special admission w cystoscopy,removal of fix device(internal)
383	38	special admission w expl laparotmy,hysterectmy,oth major oper

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